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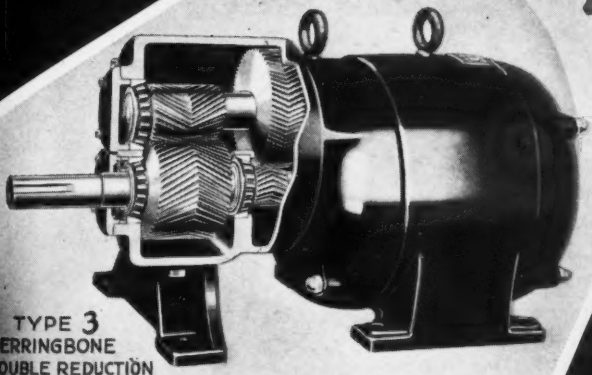

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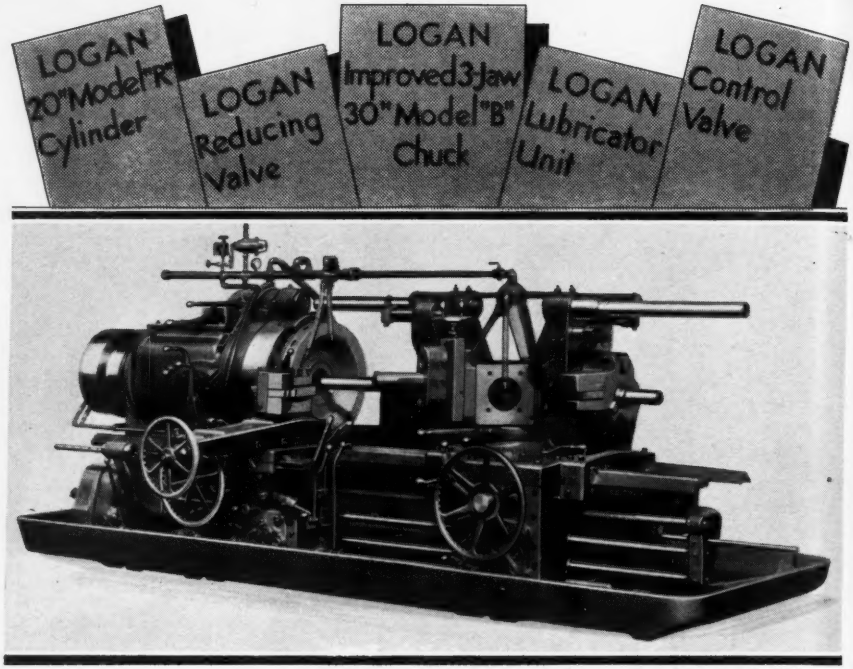

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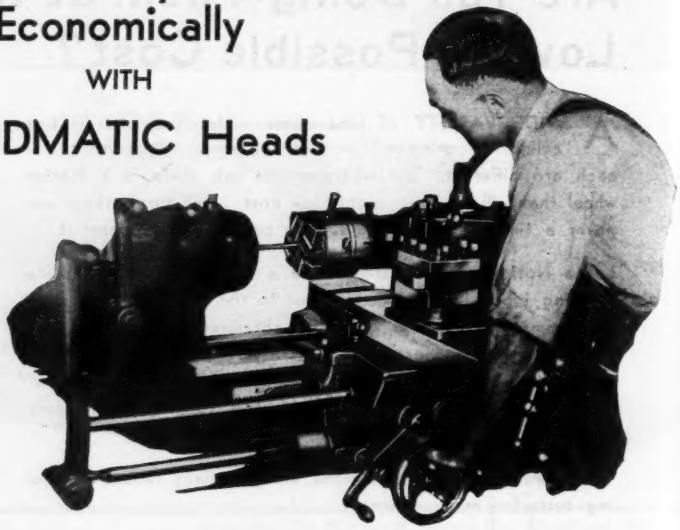

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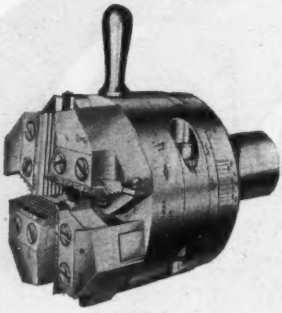

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MODERN Machine Shop

HOWARD CAMPBELL, Editor

Volume 5 SEPTEMBER, 1932 Number 4

A Magazine for Machine Shop Executives

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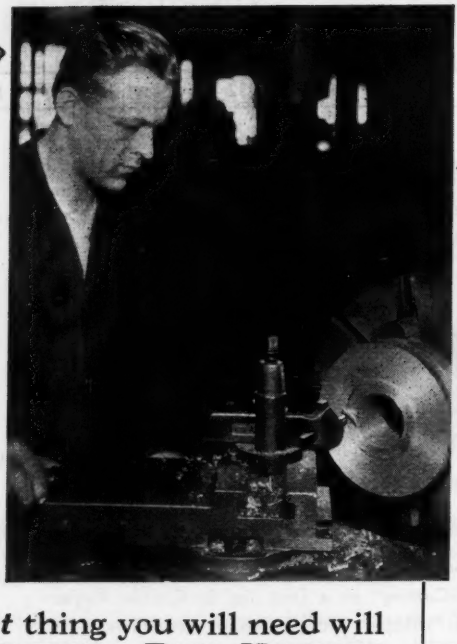

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CINCINNATI, OHIO SEPTEMBER, 1932 VOL. 5, NO. 4

In the Machine Shops of Hongkong

In view of the fact that the attention of the entire world has recently been focused on the Far East, this description of a Hongkong machine shop should be of interest.

By WALTER BUCHLER

HONGKONG is not a large city, but as a center of trade and trans-shipment for Southern China—a vast area containing a population of more than 80,000,000 people—it is one of the most important ports in the Orient. Its shipping is accordingly large and its workshops numerous.

Practically all of the craftsmen employed in the shops of Hongkong and other places in Southern China are Chinese. In the shops that are owned and controlled by Europeans (mostly British), foreign superintendents are in charge with a Chinese foreman over each of the sections. These foremen are Chinese who have started as apprentices and by sheer diligence, intelligence, and ambition have risen to the position of foreman, which position they retain, as a rule, until they are too old to work.

The Chinese fitter (assembler or bench-hand) starts working at about the age of 14 or 15 years, and serves an apprenticeship of five years. During this time he will assist the journeymen fitters, and in this way gradually learn his craft. After two

Chinese apprentices working on automobile motors.

years he may become an "improver" and in some shops it is preferred that the young learner leave that job altogether and start again under a turner (machine hand) or molder, thereby acquiring a wider experience. In the first year the apprentice's wages may be three cents (Hongkong currency) an hour, with an increase of one cent each following year for four additional years. In some Chinese workshops the apprentices are paid nothing at all, but they are provided with board and lodgings on the premises and an allowance is given them for clothing once a year on the occasion of the Chinese New Year.

Some of the Chinese fitters are very clever at their work. They have a keen sense of humor and do not harbour spite. If in the wrong, they will accept censure without a word in self-defense and with no feeling of resentment. Should a Chinese workman be wrongfully censured, however, the whole place will flare up and there will be no end of trouble with the men. The workmen employed in the shops of Southern China are more varied in type than is the case in the shops of Europe or America, and judgment as to the character and ability of the men has to be left entirely to the foreman—who knows his men thoroughly.

Whilst the men in the larger shops

Chinese molders in Hongkong workshops.

Chinese "fitters" at work in the motor repair shop of the Hongkong tramway shops.

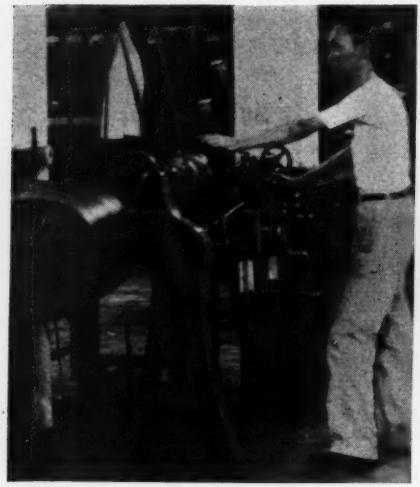
are permitted to make tools for themselves as a part of their training, they are inclined to overstep their liberty and take time and material to make all sorts of small things for themselves. When there is little work on hand, the Chinese workman makes himself scarce on the theory that "out of sight, out of mind." There is no difficulty in obtaining all the fitters needed at the present time.

Chinese fitters are very clever with their fingers and can turn out very fine and delicate articles. The Chinese workman does not, however, turn out the production that is customary in America; he is slow and easy in his ways and has not yet developed the mass production spirit. If one tries to hurry him, he is apt to become confused.

A third-grade fitter earns from 13 to 15 cents an hour; a second-grade man gets from 15 to 17 cents, and a first-grade fitter, from 18 to 21 cents. One of the difficulties encountered in the Oriental workshop is the clan spirit. The Chinese likes to work with his own clan, and the presence of an outsider, such as, perhaps, a Chinese from the north of China, is resented. A Chinese foreman invariably tries to obtain men of his own clan, and generally makes it so hot for a workman from another part of the country that he doesn't stay long. Sometimes this is effected by giving the workman wrong orders and then blaming him for bad work.

Once a Chinese workman is settled on a good job in a good shop, seldom will he change. Very rarely, also, does a Chinese think of starting a shop of his own, and only when he is paid off and is at a loss for a job does he think of trying to make a liv-

Cantonese blacksmiths at work.



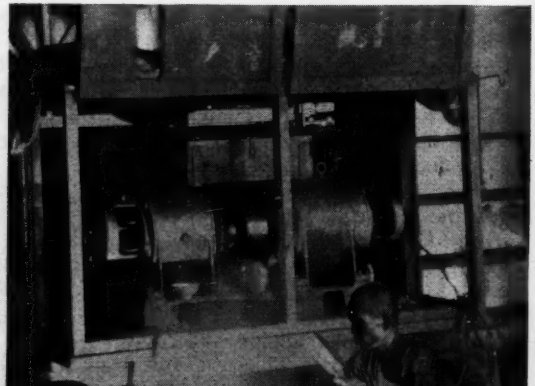
A Chinese "turner" working at an engine lathe.

ing by operating his own shop. Once started, however, he will work day and night—much longer than when employed by others—and usually obtains enough work to keep him going.

The Chinese turner here works his way up in the same way as the fitter, passing through a period of apprenticeship. On the whole, Chinese make good turners and some achieve ability to turn out some remarkably accurate and fine work. Fast production means nothing to them; they are concerned with accuracy and workmanship, and it is practically impossible to stir them out of their own slow way. Direct interference with their work is most inadvisable; supervision, yes, but not interference; if left alone the Chinese workman will get the job done in an entirely satisfactory manner.

The Chinese turner is perhaps unexcelled in repetition work; he never tires of doing work of the same kind and will work to very fine limits. He is very painstaking in the cutting of gears, which in the smaller shops will be done by hand, and quite accurately, too. The Chinese turner requires more explanation and instruction than his contemporary overseas, but once he has grasped one's meaning, he will do the job as directed and continue to do it that way for the rest of his life. If for some reason a change in method is to be adopted, a vast amount of further explanation must be made to the turner before he can be persuaded to vary from the method he learned originally.

The Cantonese turner displays the greatest contempt for the craftsman from Northern China, and, as already explained, it is very difficult to get them to work harmoniously together,



Using an arc welder in a Hongkong machine shop.

even though the latter may be the better workman. As a rule, however, the Chinese craftsman has a profound respect for the person who can teach him something or show him how to solve a problem. An actual instance will illustrate this point. One of the Hongkong workshops was given the job of turning a huge, long shaft. The superintendent was in a quandary, having no lathe in the place long enough to accommodate the shaft. One of the Chinese workmen discovered that two of the lathes were in alignment with each other, so he suggested using both lathes. His makeshift brought a crowd of workmen about, and from that day he stood high in the respect of all the men, the foreman included.

The lathe is in general use in the shops of Southern China, and the native workman is usually thoroughly familiar with its operation. When anything goes wrong with a machine or tool, however, the Chinese mechanic is inclined to patch it up with bits of wire, or string, so as to keep it going, and is apt to do more harm than good. Consequently he requires more supervision than is usual in the American workshop. When in trouble or difficulty of any kind, he goes to his foreman for advice and if the foreman cannot solve the difficulty himself, he has no hesitation about approaching the superintendent on the matter. Thus the influence of the employer extends far beyond the walls of the shop.

The Chinese workman prefers to work for a foreigner rather than for one of his countrymen, due to the fact that in the shop that is operated by the foreign concern his hours will be shorter, the pay better, and employment better and safer. The usual working day consists of nine hours. Yet it is a fact that when working for one of his own people he will work twice as hard and with twice the zest for—usually—less pay. The reason lies in the ability of the Chinese employer to get more out of his own people, with less outlay. It is doubtful that the foreign employer in China will ever be able to do likewise.

"Atlas" Bench Lathe Bulletin

A four-page 8½ x 11-in. circular illustrating and describing in detail the 9-in. screw cutting bench lathe made by the Atlas Press Co., Kalamazoo, Michigan, has been issued by that firm. Complete specifications are included, and illustrations and descriptions of the various attachments that can be used with the machine are also given. Copy free upon request.

Information for Arc Welders

Users of electric welding equipment will be interested in the bulletin "The Novice Understands and the Expert Appreciates," which is being issued by the Harnischfeger Corporation, 4420 West National Avenue, Milwaukee, Wis. The bulletin describes and illustrates the Hansen Arc Welder, together with applications, and features particularly the "internal stabilizer" which in the Hansen welder takes the place of the older-type external stabilizer. A number of advantages are claimed for the new type of stabilizer.

Copies of the bulletin may be had by addressing the company as above.

Engineering Data, Industrial Rubber Goods

A new, condensed catalog of industrial rubber goods under the title "Engineering Data, Industrial Rubber Goods" has been issued by The B. F. Goodrich Rubber Co., Akron, Ohio. Included in the text is a considerable amount of useful engineering data, such as a table on rubber transmission belting, giving h.p. capacities, minimum pulley diameters, leather belt equivalents and other information, tables of data on conveyor belts, a table by which an engineer may estimate the pressure required to deliver a given amount of liquid through hose of various diameters, and so on. Copies gratis upon request.

Making Non-Destructive Tests of Welded Joints

With a little practice, remarkably good results can be obtained by the methods described in this article.

By R. H. KASPER

ONE of the greatest hindrances to the progress of welding as a mechanical art has in the past been the inability to test the efficiency of the welded joint without destroying the product. Many broken machine parts have been patched with plate, or scrapped, because the man in charge of the work doubted reliability of the welded repair. Products have been fabricated by other means for the same reason, in spite of the fact that welding would have produced a neater and quicker job. Recently, however, the X-ray has afforded a means for testing welds without destruction, but the use of X-ray equipment is necessarily confined to volume production. For repair work or small lot manufacturing, other means of making non-destructive tests, which can be applied to each individual weld, are needed. Several of such tests are discussed in the following pages.

Applying the heat test to an automobile body.

The specifications for a weld are determined largely by the uses to which the welded part is to be put. In some cases it is necessary only that the parts be held together, the joint being subjected to no strains other than the strain of supporting the parts. In other cases the joint is required to be water-tight at low pressures, as in the case of an open tank. Or it may be required to hold liquids or gases at high pressures, as in the case of boilers. In still other cases, the joint may be subjected to tensile or torsional strains, such as occur in the parts of an automobile body.

It is unfortunate that the ultimate strength of a material cannot be determined without testing it to destruction. The general procedure is to test a sample of the material in question and assume that the balance of the material is of the same quality as the tested piece. In the case of a

welded joint, the test is made by cutting out a section of the weld and applying the usual tensile or ductility tests. However, as the former method does not actually test the product being fabricated, and as the latter method cannot truly be classed as non-destructive, this discussion will be confined to tests made on the fabricated parts without damage to the parts.

The ideal test on a welded part consists in subjecting the part to the identical conditions that would be encountered in actual use. In some cases this is possible, as in the testing of pressure tanks; in many cases, however, the cost or lack of facilities renders such tests impractical. In the latter cases, a test of either the visual or aural type must be substituted for an actual operating test.

Visual Test. In general, the most that a visual test can indicate is the surface condition of the weld, although usually the condition of the surface may safely be assumed to indicate the condition of the weld through its entire section.

The main requirements of a good weld are thorough fusion and complete penetration. A good bond is usually indicated when small globules of the weld metal protrude through to the under side of the weld. In making an examination of the weld, it should first be brushed with a stiff wire brush to remove any caked flux which might prove misleading. Chipping off the top of the weld, where it has been built up, will frequently uncover defects, and slag inclusions, blowholes, or poor fusion may be detected after the upper surface of the weld has been removed.

Welds on sheet aluminum should be washed with a 10 per cent solution of sulphuric acid to remove any chloride remaining from small quantities of uncombined flux which might cover a porous part.

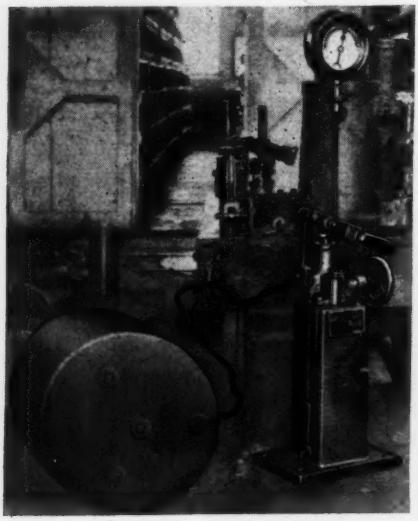
Open vessels or tanks which must be free of porosity may be tested by applying kerosene to one side of the weld; if defects are present, the kerosene will seep rapidly through to the other side. This method, however, is used only in testing for water tightness, and should not be applied to large tanks that are subject to great strains.

Testing a pipe line under pressure.

Light gauge sheet metals may be tested for thorough fusion by reheating with the blowpipe. Using a fairly long tip on the blowpipe, the joint is heated gradually and evenly, for a short distance on either side, to a medium red heat. As the weld is thicker than the original sheet, it will not heat up as readily as the sheet. A perfect weld will show as a uniform, unbroken, darker strip in the heated area. Blowholes, cold shuts, laps, or incomplete penetration will appear as bright spots in a relatively darker area. Where thorough fusion

has not been obtained between the base metal and the weld metal, these sections will show bright while the rest of the weld remains dark. This test is both accurate and economical, but can be applied only to light sheet metal.

Hydrostatic Test. Closed vessels, such as pressure tanks and pipe lines where absolute tightness under pressure is required, can best be tested by the application of internal pressure, making sure that the product will be satisfactory under operating conditions. The hydrostatic test is quickly and easily made, and requires very little equipment, the only equipment required being a small pump, a pressure gauge, and the necessary piping connections. The pump shown in the illustration is readily portable and is capable of exerting a pressure up to 6,000 lb. per sq. inch.



Pressure tank in readiness for the hydrostatic test.

To apply the test, all lower openings are closed and the vessel is filled with water until it overflows, to insure that no air pockets remain. The upper outlets are then closed and the pressure line is attached. The pump is then operated until the gauge shows the test pressure, which for all ordinary tests should be 50 per cent above the normal working pressure.

For very high pressures, a test pressure double the normal working pressure is applied. The weld is then struck with a hammer at intervals of a few inches over its entire length. If no leaks appear, the pressure is built up to three times the normal pressure, and the joints are again inspected. It is essential, when applying the hydrostatic test, that all air be excluded from the vessel; if it is not, and failure occurs during the test, parts might be thrown with explosive force whereas hydrostatic pressure alone will merely crack the vessel.

Aural Test. Aural tests are not as readily made as visual or mechanical tests, due to the fact that the human ear, though a highly sensitive instrument, must be trained to distinguish between sounds of various pitches and timbres. The test is made with the same instrument and in the same manner by which a physician tests the lungs of a patient. The stethoscope used must, however, have a soft rubber tip so as to fit closely to the irregular surface. The procedure is to strike the work with a hammer directly on the weld or within an inch on either side, while the stethoscope is held firmly nearby.

Each welded part has a characteristic sound which must be determined by preliminary tests. After the ear has become accustomed to this sound, tests are made along the line of the weld. Any irregularities in the sound will indicate irregularities in the weld, and the tone of a defective sec-

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tion can be identified with very little practice, as the vibrations are disturbed or "damped" by any unfused portions. Lack of fusion is indicated by a reedy, high-pitched note sufficiently different from that of a sound weld so that, with normal hearing and a little experience, it can readily be detected.

Using a stethoscope to test a welded tank.

Welds on large castings may be tested for soundness by swinging the casting free of the ground and striking the weld with a hammer. The principle is the same as that of testing a grinding wheel; a cracked wheel will not ring true. This method also requires some experience and ear training, but after a few comparisons have been made between good welds and poor ones, a dependable idea of the quality of the weld under test may be gained. Tests made by this method will also indicate whether strains due to shrinkage are locked up in the part under test. The sound produced by a strained section has a higher pitch than the normal tone of the piece, and if the strain is very severe, blows from the hammer may cause the strained section to crack.

No non-destructive test, however, can be as conclusive as a destructive test, nor can it indicate the ultimate strength of the material. But if the test is carefully and intelligently applied, it will give a fair idea of the condition of a welded joint and what may reasonably be expected of it.

Clark Tructractor Catalog

The Clark Tructractor Company, Battle Creek, Mich., has issued a pocket edition catalog in which all the various types and kinds of Tructractors, Truclifts, Tructiers, Tilt Trucks, Clark Twinveyor, Trailers, and other material handling equipment made by this company are described and illustrated. Clarktor sweepers, automatic dumps, and shovels are included. The catalog contains 48 pages, with complete description and photograph of each piece of equipment. Copies gratis.

Bulletin On Magnetic Clutches

Dings Magnetic Separator Co., 509 E. Smith St., Milwaukee, Wis., has recently prepared a 16-page bulletin on the installation and use of magnetic clutches for special and general power transmission applications. The bulletin describes three types of Dings magnetic clutches —single disk, multiple disk, and serrated disk. A number of installation diagrams are reproduced and the method of calculating the required horsepower rating is discussed in detail. Extensive tables of performance data are also included. Copies of this bulletin may be obtained by writing to the manufacturer.

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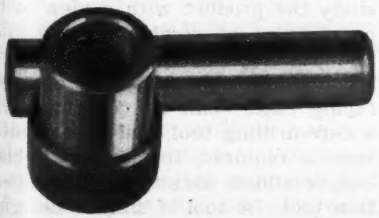

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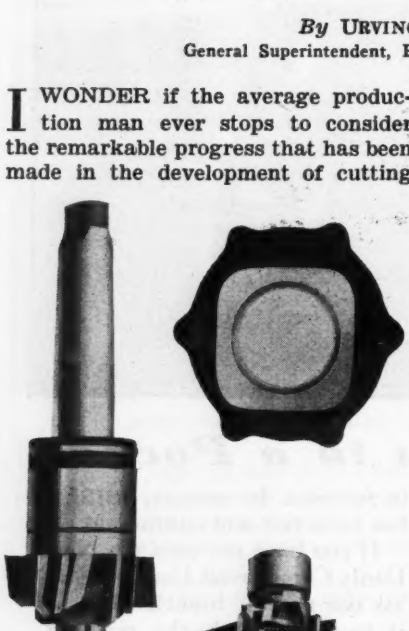
COMMERCIAL DIE SETS

The Importance of Proper Tooling

By URVING G. THOMAS,
General Superintendent, Eclipse Counterbore Company.

I WONDER if the average production man ever stops to consider the remarkable progress that has been made in the development of cutting tools from the single diameter cutter to the stepped cutter and finally the multi-diameter cutter. Tools are now made that perform up to eight operations at one handling, as compared to former methods in which eight separate handlings were required.



This tool faces a 4½-in. diameter, chamfers 90 deg., bores 2½-in. diameter, chamfers 90 deg., and core drills 2.330-in. diameter on an automobile universal joint cover. The cover is shown at upper right, and below, right, is one of the cutters after it has been used up.

Upon the design and quality of the cutting tool depends, in many cases, the maintenance of production, freedom from the annoyance and cost of frequent shut-downs, the amount of machine tool equipment required, amount of jig or fixture equipment required, and the number of operators required—all of which have an important bearing on the costs. And yet the cutting tool is usually the last thing considered when plans are being considered for the production of a new product. After the design of the product has been settled upon, plans are made for a factory, a tentative production schedule is laid out, and an estimate is made of the number and kinds of machines, jigs, fixtures, and other equipment that may be necessary.

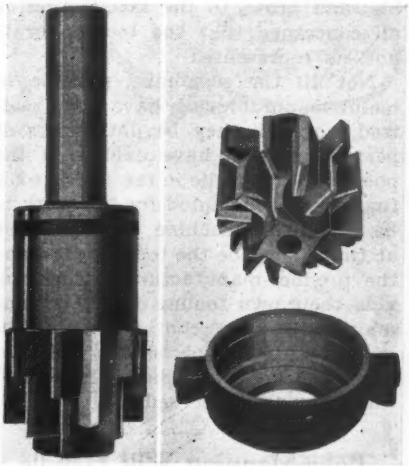
Everything else done, someone is given the relatively unimportant (?) task of making a list of the cutting tools that will be required. The first thought is that all the tools necessary can be purchased in the open market, or ordered from a catalog. And so they can, if economy is of no importance. If the tools are selected by a thoroughly competent man, he will study the product with a view to the possibilities of combining operations and making each cutting tool do as much work as possible. Perhaps a facing cutter can be combined with a core-drilling tool, and if a counterbore is required, the necessary blade can be added, making a three-operation tool. A tool of similar design is

now used in a railway shop for reclaiming air brake valves in which the threads have become defective, the tool having blades that bore out the old thread, counterbore for rethreading, and face the top.

An oil pump manufacturer uses a multi-diameter cutter which drills the core in a hole in a water pump housing, counterbores the hole, chamfers, and faces the end of the casting. A manufacturer of universal joints for automobiles uses a tool that faces a 4½-in. diameter on the cover, chamfers the inner edge of the hole to 90 deg., bores a 2½-in. diameter, chamfers another diameter to 90 deg., and core drills to 2.330 in. diameter. In a large motor truck plant tools are used that perform eight operations in one, as follows: Face 3⅞ in. dia., Bore 3.628 in. di., Bore 3.534 in. dia., Chamfer 1/16 x 45 deg., Face 3.534 in. dia., Bore 3.156 in. dia., Face 3.156 in. dia., and Core Drill 2.0515 in. diameter. This tool eliminated several operations, one machine, five cutters, the labor cost of one operator, and cut the former production time in half.

Such tools as those described above are, of course, especially designed for the jobs, and cost somewhat more than standard tools. To the purchasing agent who is guided by price figures, the cost may seem sufficient cause for rejection. However, the purchaser who realizes that he is buying performance—not steel—can easily see that the price of such a tool is in reality much lower, when the costs of the combined operations per piece are considered. To such a purchaser the value of the multiple-operation tool is readily apparent.

Manufacturers of multiple-operation tools are fully aware that the design of such tools calls for engineering of a specialized nature, and are as a rule prepared to handle the designing for their prospective customers. The designers and manufacturers of modern tools must not only be good engineers and mechanics, but must also be familiar with the newest in production methods. In many cases the selling price of the proposed product has been determined before manufacture is started, making it incumbent upon the designers of the tools to find ways and means to keep the manufacturing costs within certain bounds. In such a case it is imperative that the user and maker of the tools maintain close contact, and the closer the contact, the greater will be the gain for the user.



The tool at the left is used to face 3⅞-in. diameter, bore 3.628-in. diameter, bore 3.534-in. diameter, chamfer 1/16-in. by 45 deg., face 3.534-in. diameter, bore 3.156-in. diameter, face 3.156-in. diameter, and core drill 2.0515-in. diameter on the clutch housing shown at lower right. Above is an end view of the cutter.

Delivery of the tool to the customer does not release the tool manufacturer from further responsibility. The customer may put an inexperienced

operator on the job, or the grinding department fails to sharpen the tool properly, or the tool is run too long without being resharpened, and then the report comes back that the tool is not working properly. When this happens, a representative should go to the customer's plant, if at all possible, and prove to the satisfaction of all concerned that the tool is, or is not, as represented.

Not all the economies possible in metal manufacturing have been realized, nor will they be until users of perishable tools have exhausted the possibilities that lie in the use of tools that are best adapted for the work to be done. If machine builders who, at times, provide the tooling also, and the product-manufacturers who provide their own tooling will form and maintain closer contacts with the manufacturers of perishable tools, the contacts thus established will be profitable for all concerned.

Behr-Manning Will Handle Norton Pike Products

The Norton Company, Worcester, Mass., who recently announced the change of name of the Pike Manufacturing Company to the Norton Pike Company, following their acquisition of the former company, announces that after September 1st the sales and distribution of Norton Pike products in the United States will be handled through the Behr-Manning Corporation, which is affiliated with the Norton Company.

Sales headquarters will be transferred to the headquarters of the Behr-Manning Corporation, at Troy, New York, and Norton Pike products will be stocked in the various Behr-Manning warehouses throughout the country.

Heavy Duty Timestarters

A new leaflet entitled "Heavy Duty Timestarters" has been published by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., and is available from any district office or direct from the advertising department of the above address.

The timestarters are designed for the positive starting and protection of constant speed direct current motors in mill and mine service. They are particularly applicable for the low maintenance operation of fans, blowers, pumps, machine tools, and on crane or trolley circuits that may be subject to wide fluctuations of voltage.

"Geometric" Die Head Booklets

The stationary self-opening die heads and the rotary self-opening die heads of the "K" line, made by The Geometric Tool Co., New Haven, Conn., are described and illustrated in two booklets that have been published by this firm. The stationary type—KH—die heads are intended for use in hand screw machines, turret lathes, and other similar equipment. The rotary or KD type heads are for use in live spindle machines. The book devoted to each type describes the construction, use and operation of the head in detail, and gives complete specifications. Copies of the booklets can be had upon request.

Janette Motorized Speed Reducer Bulletin

The Janette Manufacturing Co., 556 West Monroe St., Chicago, Ill., has issued Bulletin No. 1131, describing and illustrating the various types of motorized speed reducers made by this company. These include the single reduction worm gear types, double reduction worm gear types, and single reduction spur gear types, all of which are described and illustrated in detail. Copies gratis.

Insa-Lute Cement and Compounds Catalog No. 32

Every plant engineer should have a copy of Catalog No. 32, which is now being distributed by Technical Products Co., Sharpsburg Station, Pittsburgh, Penna. The catalog contains complete information and instructions as to the features and uses of the cementing, insulating, acid-proofing, water-proofing, fire-proofing, furnace-and-pipe-sealing, pore-and-crack-filling, and other industrial compounds made by this firm. Copies gratis upon request.

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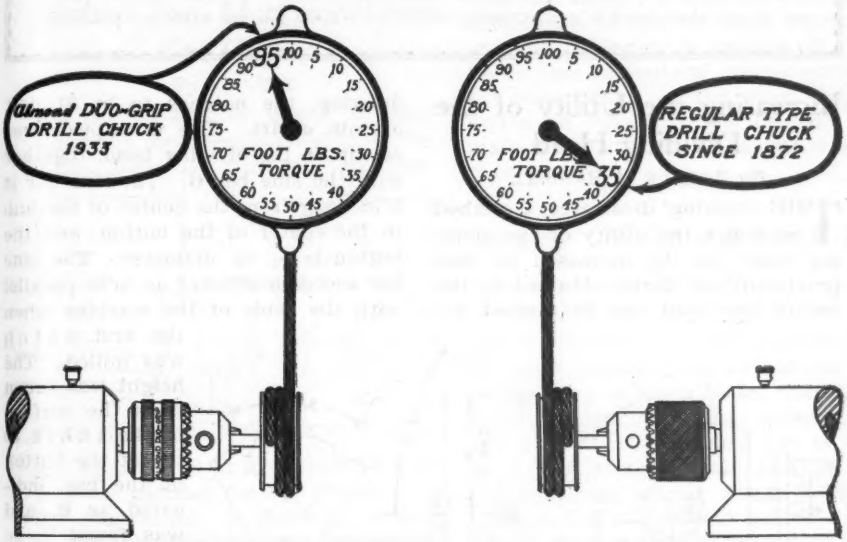

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3/16" Capacity	$3.00	1/2" Capacity	$4.50
1/4" Capacity	3.00	5/8" Capacity	4.50
5/16" Capacity	3.50	3/4" Capacity	6.00
3/8" Capacity	3.50	1" Capacity	7.00

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Ashburnham, Mass.

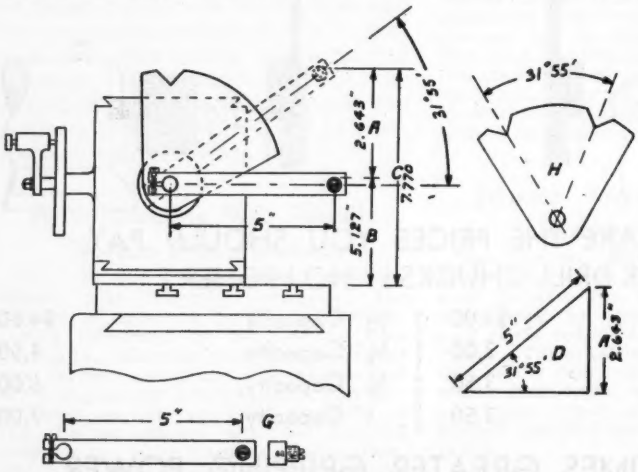
IDEAS FROM READERS

This department is a clearing house for ideas . . . If there is a "kink" or short cut in use in your shop, send in a description of it . . . We will pay for each one published.

Increasing the Utility of the Dividing Head

By ARTHUR H. SANDELL

THE drawing illustrates a method by which the utility of the dividing head can be increased so that practically all angles obtained by the use of the head can be divided not only by degrees, but also by minutes and seconds. The writer has used this method in a shop where the only dividing head available was of obsolete design.



Drawing illustrating use of the sine bar to increase the utility of the dividing head.

One of the operations performed with the obsolete head was that of milling two notches in the periphery of a segment, shown at **H** in the drawing, the notches to be 31 deg. 55 min. apart. The work-piece was set up on the dividing head, together with the sine bar **G**. The sine bar is 5 in. long from the center of the hub to the center of the button, and the button is ½ in. diameter. The sine bar was so positioned as to be parallel with the table of the machine when the first notch was milled. The height was taken from the surface of the table to top of the button on the bar, indicated as **B**, and was found to be 5.127 in. In order to be able to accurately gauge the dimension corresponding to 31 deg. 55 min., it was necessary to find the dimension **A**, which was the result of the calculation **D**. The dimension **A** was found to be 2.643 in.; added to the dimension **B**, 5.127 in., it produced the total height at which the button on the sine bar should be set, indicated at **C** as 7.770 inches. With the bar at this position, the work was properly positioned to mill the second notch.

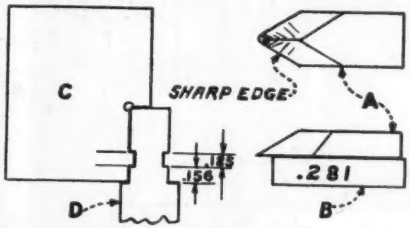
This method of obtaining close measurements on odd angles will be

found useful in many cases, particularly as it is impossible to index all angles accurately, even with modern heads.

Scriber for Marking Lines On Gages

By C. COLE

IN the making of gages, it occasionally becomes necessary to inscribe lines that must be both clear



Scriber for use in marking lines on gages.

and accurate as to location. The lines may be intended for the guidance of the gage-maker in finishing certain parts of the gage to given dimensions, or they may be intended to be etched on finished gages, as in the case of "go-and-no-go" lines on a taper plug gage. In either case, it has been the experience of the writer that the tool illustrated here is the best type of tool with which to mark off the lines.

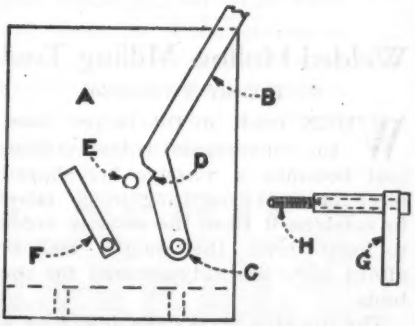
The tool, indicated at **A**, is made of tool steel, hardened, and ground to a sharp edge. The tool is used in connection with Johansson gage blocks to obtain the required dimensions, as indicated at **B**. The drawing portrays the use of the scribing tool, together with a Johansson gage block, for marking off lines on a gage, **C**, that is used to check the position of a "neck" in the shaft **D**. In this case the gage is placed on end on a surface plate, and blocks of 0.156 in. and 0.281 in. thickness are used to locate the scriber at the correct heights.

When lines are to be etched on a finished gage, beeswax is melted over that portion of the surface in which the etching is to be done, then the lines are inscribed and acid is poured into the lines. When the lines are sufficiently etched, the acid, together with the beeswax, is washed off. If the scriber is made of approximately the same width as the gage blocks and a bit longer, it will be easy to move about with the block with which it is used.

Cutting Off Round Stock In the Shaper

By CHARLES R. WHITEHOUSE

FOR cutting off round stock of small diameter, the tool shown in the drawing is much faster than any other method excepting perhaps, a punch press, and this tool can be set up in approximately half the time required to set up the press. Consequently it is particularly valuable for use on short runs, and the writer has



Tool and stop for cutting off stock in the shaper.

used it many times on small lots and when the presses were overloaded.

The tool is used with a shaper. The angle plate **A**, to which the cutting off tool is attached, is bolted to the shaper table. The cutting off

tool **B** is formed as shown, with the lower end of the tool pivoted to the angle plate as indicated at **C**, and the upper end of a size that will easily slide through the opening in the toolpost. The notch **D** is the cutting edge. At **E** is a hole in the plate through which the stock is passed to be cut off, the length of the piece being controlled by a swing stop at **F**.

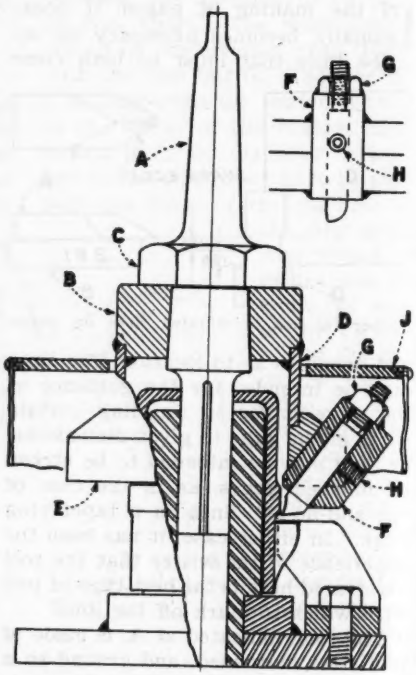
The stop **F** consists of a piece of flat stock **G**, drilled at one end to receive the screw **H** by which it is attached to the angle plate. The length of the screw is determined by the length to which the stock is to be cut, and must be long enough to pass through the stop, well into the angle plate, and leave room enough between the stop and the plate for a bushing of the exact length of the cut pieces. The stock is fed through the hole with one hand, the other hand being used to swing the stop to position in front of the hole and remove it again as the cutting tool moves forward. Bushings and screws of varying lengths are used as the length of the work varies.

Welded Hollow Milling Tool

By ROBERT TWEEDSIDE

WHEN made in the larger sizes, the conventional hollow milling tool becomes a massive bell-shaped piece of steel, requiring much labor to machine it from the solid in order to keep down the weight and to afford seats and adjustments for the tools.

The drawing shows the design of a lighter and cheaper tool of comparatively large size, the particular tool shown being designed to machine an outer or peripheral surface 3⅝ in. in diameter by ¾ in. wide near the center of a cast iron sleeve that is 4¾ in. long. The No. 4 Morse taper shank and the fluted pilot are made in one piece, **A**, with a central portion which has both a taper and a thread, the taper engaging a tapered hole in the head **B**, where it is locked with a nut **C**. To the lower part of the nut is welded a short section of 4-in. pipe **D**, which in turn carries the beveled ring **E**. The ring is slotted at intervals of 120 deg. to receive three tool-

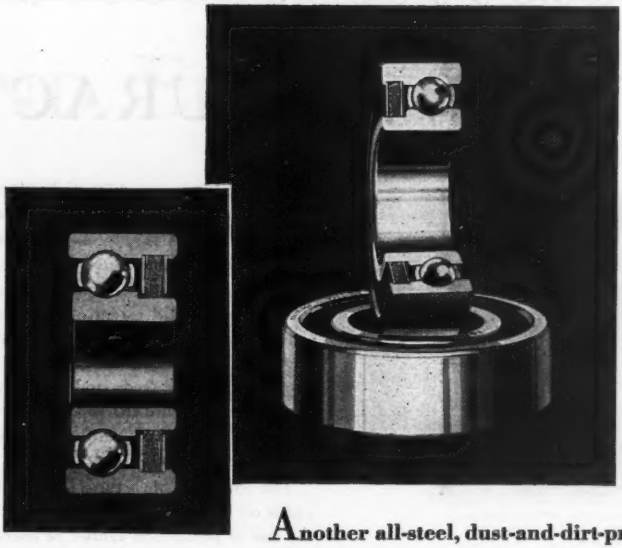


Design of Welded Hollow Milling Tool.

holder blocks **F**, which are set in at the proper angle.

To take end thrust and provide for adjustment of the tool, a ½-in. nut **G** is welded to the upper end of each tool block and a setscrew is threaded into the nut. When properly set, the tool is locked in position by means of the setscrew **H**. To guard against danger from the projecting ends of

(*Continued on page 28*)



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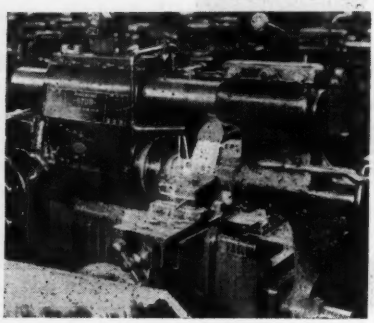
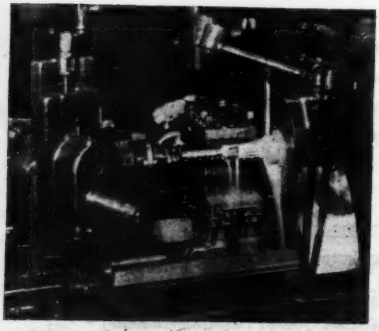


Courtesy of National Acme Company, Cleveland, Ohio

OPERATION: ROUGH TURN AND FACE.
MACHINE: SUNDSTRAND STUB LATHE.
MATERIAL: STEEL FORGING.
SPINDLE SPEED: 80 R.P.M.
FEED: .022 INCH
CUTTING SPEED: 83 FEET PER MINUTE
LUBRICANT: 1 PART SUNOCO TO 20 PARTS WATER



Courtesy of Ohmer Fare Register Company Dayton, Ohio

OPERATION: SPOT, DRILL, TURN, REAM, CUT-OFF
MACHINE: JONES & LAMSON LATHE.
MATERIAL: 2⅜ IN DIAM 1020 COLD ROLLED STEEL
PRODUCTION: 14 PIECES PER HOUR
MACHINE LUBRICANT: SUN CIRCO LIGHT MEDIUM
CUTTING LUBRICANT: 1 PART SUNOCO TO 20 PARTS WATER

The production machine tool of tomorrow will be purchased, not on design and appearance, but on results obtained, and the yield on the capital invested.

But in order that these machine tools may function to the full extent of their rated capacity, it is necessary that they have simplified and effective tooling, the application of the proper speeds and feeds, and a cutting lubricant that will insure the production of accurate, quality finished parts with long runs between tool grinds.

The influence that the cutting lubricant exerts on both the amount of production and the cost of production cannot be overemphasized. It is an important factor in machine tool efficiency.

Sunoco will aid your machines in maintaining their rated efficiency. In many operations the production of finished parts on your lathes, drill presses, millers, and other machine tools will show an increase. The

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adaptability of Sunoco to faster machine operation encourages the use of higher spindle speeds. Sunoco will also assist your machine tools in producing work with greater accuracy and improved finish. Longer tool life between grinds will reduce your down time to a minimum.

With Sunoco, speed of cut, freedom from glazing, increased wheel life, less heat, and minimum distortion of work and perfection of finish, plus greater production are evidenced in the grinding operations.

Sunoco is hygienic, and even after prolonged use, bacteriological tests prove that it will not develop pus forming germs or pathogens which cause skin inflammation.

We welcome an opportunity to demonstrate the merits of Sunoco where it should be demonstrated—in your own plant, under your own operating conditions.

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British Sun Oil Co., Ltd., London, England

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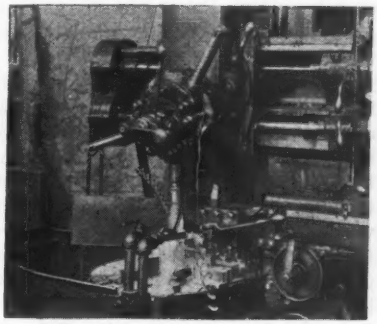
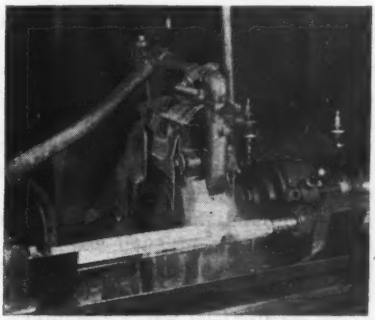
Courtesy of The Bullard Company, Bridgeport, Conn.



OPERATION: DRILLING AND TURNING PINION.
MACHINE: BULLARD VERTICAL TURRET LATHE.
MATERIAL: CHROME NICKEL STEEL.
SPEED: 85 FEET PER MINUTE. 70 R. P. M.
FEED OF DRILL: .007 INCH PER REV. 2¼ INCH DRILL.
BEVEL SWEEP: .014 PER REV.
LUBRICANT: 1 PART SUNOCO TO 20 PARTS WATER.

Courtesy of Autocar Company, Ardmore, Pa.



OPERATION: GRINDING TAPER ON MAIN SHAFT.
MACHINE: NO. 11 BROWN & SHARPE
MATERIAL: 5% NICKEL STEEL
WHEEL SPEED: 1900 R. P. M.
WHEEL DIAMETER: 14 INCHES
PRODUCTION: 40 PIECES PER HOUR.
LUBRICANT: 1 PART SUNOCO TO 40 PARTS WATER.

Ideas From Readers

(*Continued from page 22*)

the adjusting screws when the tool is revolving, a guard consisting of a loose flange to which a leather skirt is attached is dropped over the tool so that it rests on the upper ends of the screws as shown at **J.**

The tools are set with the aid of a circular gage that is turned and ground to the correct diameter and bored to a slip fit on the pilot, by which it is centered. The work is held for this operation by slipping it over a locating stud attached to a base that is clamped to the machine table. The base also carries a stop that projects between lugs on the work and prevents the piece from turning with the tool. The finish produced by this tool is equal to good lathe work and the job is done at low cost by using a gang drill with several tools.

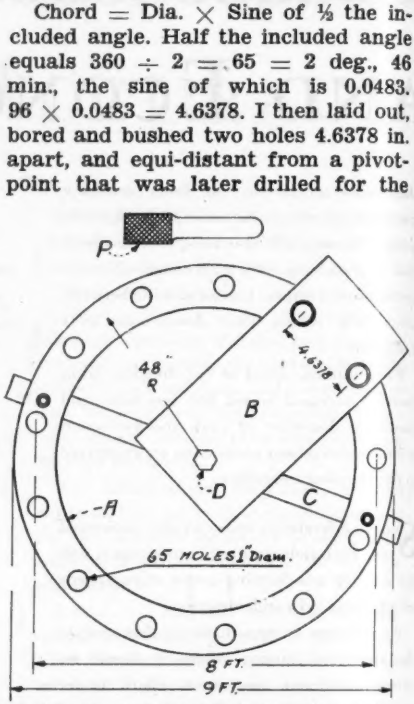
"Short-Cutting" on a Drill Jig

By CHARLES KUGLER

WHILE working in a large ship yard, the writer was given the task of making a ring-drill jig, the design of which is outlined in the accompanying drawing. The jig, **A,** contained 65 holes in a circle of a 48-in. radius, and although it was a simple enough matter to lay out the holes, I found that there was no machine available of such size that the piece could be indexed. As an alternative, I made a jig-plate, **B,** that could be used to space the holes, locating by inserting a plug in one hole and drilling through the other, following this method until all the holes were drilled.

In making the plate **B,** I first found the chord, or distance between the jig-holes, by using the following formula:

Chord = Dia. × Sine of ½ the included angle. Half the included angle equals 360 ÷ 2 = 65 = 2 deg., 46 min., the sine of which is 0.0483. 96 × 0.0483 = 4.6378. I then laid out, bored and bushed two holes 4.6378 in. apart, and equi-distant from a pivot-point that was later drilled for the



Drawing illustrating method of making a ring drill jig without using indexing equipment.

stud **D.** A strip of steel **C** was then bolted to the jig, directly across the center, and a hole was laid off and bored for the stud **D,** after which the plate **B** was anchored to the piece **C** by the stud **D.** The last operation in making the jig was to make a plug, **P,** which is a push fit in a one-inch hole.

With the plate **B** anchored to piece **C,** it was clamped in one position and the first hole was drilled and reamed through the bushed hole in the plate. The clamp was then removed, and the plug **P** was inserted through the bushed hole and the hole in the jig. The plug held the plate **B** in place

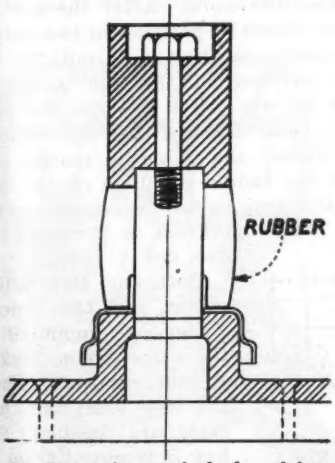
while the second hole was drilled. Then the plate **B** was moved around and the plug **P** was inserted in the second hole, while the third hole was drilled, this cycle being repeated until all the holes in the jig were drilled, after which they were fitted with bushings.

It is obvious that any error between the two holes in the plate **B** would be multiplied as the operation progressed, but care was taken to make this dimension accurate, and the jig, when finished, was plenty good enough for the job in hand.

Rubber Stripper Is Both Cheap and Efficient

By CHAS. H. WILLEY

A SUGGESTION made some time ago by one of our die-setters and later adopted has resulted in a considerable amount of savings in both time and material. The idea consisted in using rubber sleeves for strippers, the sleeves being slipped onto the punches after the job is set up. The rubber stripper works very well on piercing or blanking jobs where the blanks or punchings fall through the die.



Drawing illustrating method of applying rubber sleeve to act as stripper.

As shown in the illustration, the rubber should be heavy enough to afford the necessary strength and resiliency, and should be relieved on the inside at the lower end so that it will not adhere to the punch and thus fail to function. The rubber stripper can be applied to the irregular-shaped punch as well as to the round one, but in this case the stripper must be made from layers of inner tubing. The layers are slipped over the tool a layer at a time, the whole being cemented together with rubber patching cement. They will adhere to the punch by compression in the same manner as the round sleeve. The writer has seen this idea applied to more than one hundred tools with success, and in every case it has been a money-saver.

The Proper Method of Etching

By ROBERT MACGREGOR

OF the many machinists or toolmakers who are called upon at intervals to etch letters or figures in steel tools or parts, it is probable that not one in a hundred uses the correct method. The usual procedure is to melt the beeswax with a heated rod, allowing the beeswax to drop on the work so that it will cover the spot to be etched, and then use an ordinary scriber to cut the lettering through the wax so that the acid can get to the steel. The result is usually more or less "ragged" and unsatisfactory unless the etcher is skilled in the art of lettering.

The best results can be obtained with the least amount of effort by the use of the following method. The let-

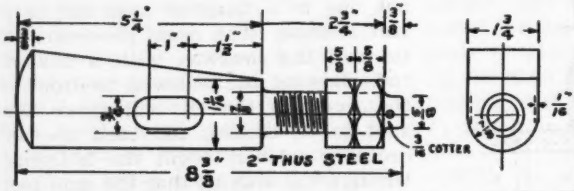
tering should be done on the work first, using a pencil and drawing guide lines in the usual manner where a good job of lettering is to be done. The writing may not show very clearly, but the effect will be surprising when the wax is applied. It will show up as clear as pencil writing on white paper. Then, instead of dropping the melted wax on the work, the workpiece should be heated until the wax melts and runs over the surface of the work. The result will be a very thin coating of wax—but sufficient to protect the surface from the acid.

The last step consists in tracing the lettering with a scriber that has been blunted by rubbing the point on a piece of emery cloth. The acid is then applied in the usual way, and when finished, the wax is removed with a piece of waste that has been soaked in kerosene. The results will justify any extra work involved.

Milling Front End Main Rod Keys

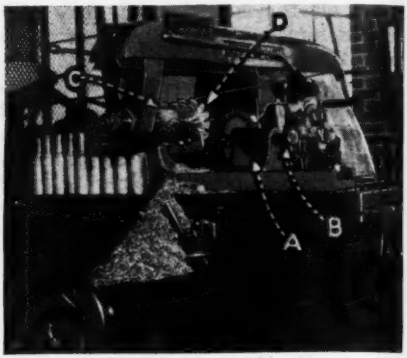
By H. H. HENSON

ALL railway machine shop foremen know what a tedious task it is to plane locomotive front end main rod keys on the shaper, when the keys have round backs. By using a milling machine for this job, as shown in the illustration, a difficult task can be rendered comparatively easy.



Drawing of Locomotive Front End Main Rod Key.

The first move is to lay off the key and drill a center in each end. Then a lathe dog is fastened to the stud end of the key and the key is swung between the centers of the fixture A,



Equipment for milling front end main rod keys.

shown on the milling machine table in the illustration. The center B can be screwed in or out to tighten or release the work. After the key has been placed in position in the fixture, the first operation is to mill the two flat surfaces of the key, using the slab milling cutter C. When the piece has been finished to the required thickness, the table is moved over and the radius is milled on the back of the key, using the concave cutter D. This operation is completed in one cut.

Both the slab milling cutter and the concave cutter are mounted on the same arbor, making it unnecessary to remove the key until the three sides are finished. The key is removed from the machine and laid off for the taper, which is machined by using the shaper. The stud portion of the key is now turned and threaded in the lathe and the key is practically finished.

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In the average shop enough keys can be milled with the equipment shown in 24 hours to maintain approximately 100 locomotives for a year. Note the heavy chips that have been removed by the cutters, and the finished keys standing on the machine table.

G. E. No. 1281 Oil and Gasoline-Proof Gasket Compound

Neither hot oil nor gasoline will affect gaskets made of a new substance that has been developed in the research laboratories of the General Electric Company, Schenectady, N. Y. Designated as No. 1281 Gasket Compound, it consists of a gray or brown, odorless and sulphur-free alkyd resin material. It is flexible and practically incompressible, and there is no noticeable hardening or stiffening in outdoor exposure tests. At temperatures below zero F. the compound is somewhat brittle, but this does not affect its resiliency as a gasket when assembled in a joint.

Among applications recommended are those where resistance to hot oil is of primary importance, where exposure to naphtha, gasoline, kerosene, benzine and similar solvents may occur, where moisture is to be excluded and oil resisted, where there may be prolonged exposure to ozone, and where electric corona may occur.

Gaskets of the new material are now used in the assembly of solid-type compound-filled bushings for oil-filled apparatus, and between the bushing and the apparatus. Bushing assemblies of the compound with porcelain, brass, cast iron, and copper have withstood alternate heating and cooling while under pressure and in contact with oil for long periods of time. Tests have also indicated that the gaskets are satisfactory for sealing-ring gaskets for the top of vacuum oil-treating equipment, for hydrogen-filled rotating machinery, and under covers of oil-filled apparatus.

The material is now available in sheets up to 13 x 36 in., in thicknesses from 1 mil. to ⅛ inch. Round gaskets available at present have a maximum diameter of 2½ in. and a maximum thickness of ⅛ in. Larger sizes will be available later.

Monarch Announces Automatic Force Feed Lubrication

The Monarch Machine Tool Company, Sidney, Ohio, has announced the application of automatic force feed lubrication to the bed, carriage, apron, and compound rest as standard equipment on all Monarch lathes. All the major units of the lathe are oiled by a centralized lubrication system, all parts of which are built-in and concealed. There is nothing to get out of order, and the oil sump can be quickly cleaned.

A pressure pump, automatically driven by the apron hand wheel, supplies oil under pressure to every part of the carriage as it bears on the bed and to the compound rest bottom slide bearings, the oil being "metered" at each point so that the correct amount is supplied. Oil is supplied through tubes, from a reservoir in the apron, to the apron roller bearings. The apron gear train is oiled from the larger gears, which dip into the oil reservoir.

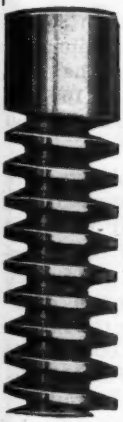
The headstock is oiled by the splash system, and filtered oil is automatically supplied to the Timken spindle bearings. It is claimed that the Monarch system of lubrication prevents wear, provides ease of operation, prolongs life of operating parts, and saves operator's time. A bulletin on Monarch Automatic Force Feed Lubrication can be had by addressing the firm as above.

Electric Belt Conveyor Furnace Bulletin

An illustrated four-page leaflet entitled Electric Belt Conveyor Furnace, has been published by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. This publication describes the applications and uses of this type of equipment. It is especially useful for such parts as nuts, bolts, bearing races, gears, pinions, forgings, and other parts which require duplicated uniformity of heat treatment. Such parts are easily and speedily handled in a belt conveyor furnace.

Copies of the publication L.20543 may be obtained from the nearest district office or direct from the Westinghouse Company at the above address. Address Advertising Department.

PERKINS
Worms and Gears



insure smoother operation and greater durability for your machines. PERKINS Ground Thread Worms and Gears are produced by specially designed equipment. They are "mirror finished" by a special polishing operation and each gear is made to conform to PERKINS Super Standards of Quality.

Investigate and let us estimate on your requirements.

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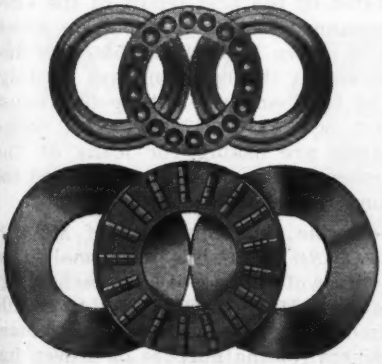

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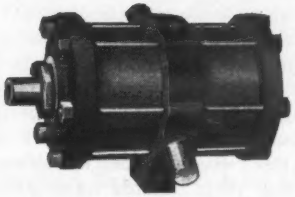

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Over the Editor's Desk

At Last?

THERE is no question but that business is, at the present moment, on the up-grade. What it will do tomorrow, or next week, is problematical, but as we go to press a feeling of optimism and hopefulness is evident on all sides. Stock prices have risen 40 to 50 per cent from the July low point, bonds have joined in the parade, and commodity prices are bringing up the rear. We are doing no predicting; we have our fingers crossed, and we are simply watching, listening, and hoping with the rest as the number of apparently significant events increases.

During the last week of July, according to a survey made by the United Press, some 30,000 workers were re-employed in mills and factories throughout the country. Reports of the United States Employment Service reveal that the July expansion in industrial activities is the first noticeable movement of the year. Conditions in the boot and shoe industry have improved, a number of these plants increasing from a part-time to a full-time basis. Thousands have been re-employed in the textile industries, also in the anthracite coal fields. Increases in the volume of employment in the iron and steel mills have been very slight, but the prices of scrap steel have advanced, which is usually considered a forerunner of increased activity in these industries.

Despite the fact that the Ford Motor Company shut down for several weeks for the annual vacation and inventory, the industry as a whole has increased its schedules. The Graham-Paige Motors Corporation increased its August production schedule by 50 per cent. The shipments of Plymouth cars during the first seven months of 1932 were 162 per cent of those for the similar period of 1931.

Among the more hopeful signs are the reopenings of numerous banks that have been closed, and a decided lessening in the number of bank closings. The withdrawal of gold from the United States by foreign countries has stopped, and since the middle of June more than $82,000,000 in gold has been added to the Federal Reserve.

The manner in which the Reconstruction Finance Corporation is operating to aid railroads, banks, and other financial institutions is illustrated by the first report of the Corporation to be made public, in which it is shown that $45,057,556 was disbursed in the last ten days of July. The total amount lent up to August first was $866,047,522. Few large banks are asking for loans at the moment, indicating that the need for funds has shrunk considerably.

By the time this issue of MODERN MACHINE SHOP has been mailed, a number of banks will have been designated as Home Loan Banks, to handle funds that will be available to homeowners for the purpose of preventing foreclosure on home properties as a consequence of lack of cash funds. Thus homes will be saved to their owners instead of being thrown into the hands of mortgagees who will be unable to convert the properties into liquid funds after they get them.

Let us hope that the improvement continues.

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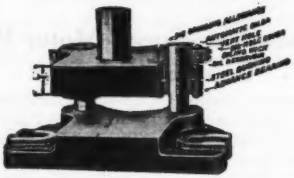

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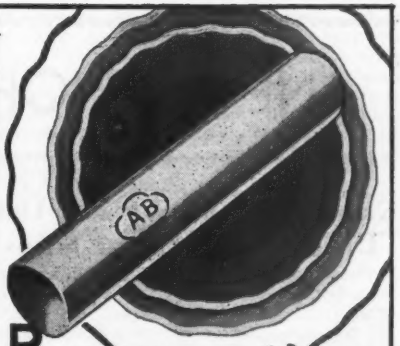

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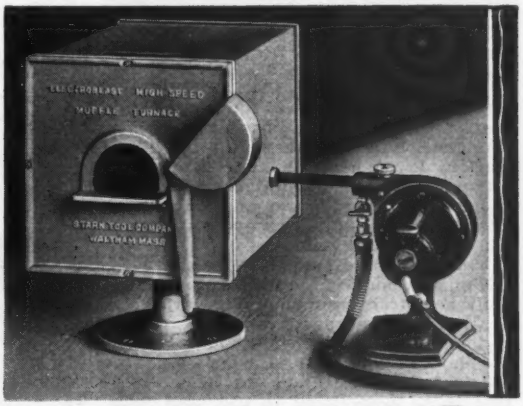

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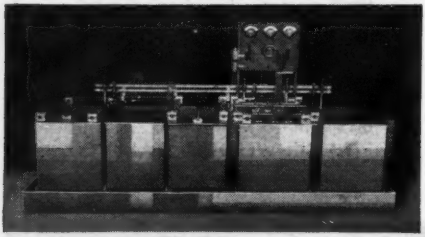
NEW SHOP EQUIPMENT

Compact Chromium-Plating Unit Designed for Machine Shops

The chromium plating of drills, taps, reamers, gages, dies, punches, and many other tools and parts which are made to last longer by this process may be now carried on as a part of the regular routine of the machine shop tool room. United Chromium, Incorporated, 51 East 42nd Street, New York, N. Y., has designed a compact chromium-plating unit expressly for use in machine shops. The unit, which is shown in the illustration, is so compact that it may be set up anywhere and quickly connected to current, steam, water and waste outlets, and is so simple to operate that it can be operated successfully by any workman of ordinary intelligence.



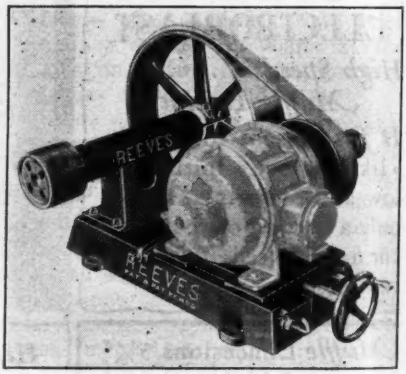
Chromium-Plating Unit Designed Especially for Machine Shops.

The unit makes available all the advantages of chromium plating with none of the disadvantages, such as delays incidental to sending out the parts to be plated. The unit is complete, with all parts assembled on one base. It is said to be economical to use, and is of sufficient size and versatility to plate the many tools and parts upon which chromium can be applied to advantage. In the design of the unit are incorporated the wide experience of the engineers of United Chromium, Incorporated, correlated to produce a unit that will meet the needs of the average machine shop at the lowest possible cost.

Reeves Vari-Speed Motor Pulley Countershaft Unit

Reeves Pulley Company, Columbus, Ind., announces the Reeves Vari-Speed Motor Pulley Countershaft Unit, an adaptation of the Reeves Vari-Speed Motor Pulley, especially designed for unusual speed reduction requirements. The new unit embodies the fundamental design of the standard Vari-Speed Motor Pulley, which consists of two opposing cone-faced discs, one stationary and one sliding, and an adjustable power compression spring, all mounted on the shaft of a standard electric motor. This assembly is mounted on a special sliding motor base. A V-belt forms the connection between the sliding discs and the driven pulley.

A turn of the handwheel in one direction moves the motor and disc assembly toward the driven pulley; in the other direction, away from it. As the motor pulley moves away from the driven pulley, the sliding disc moving out laterally, the V-belt travels over a smaller diameter between the discs, thus effecting speed reduction. When the handwheel is operated to move the



Reeves Vari-Speed Motor Pulley Countershaft Unit.

motor toward the driven shaft, the V-belt will operate from the small to the full diameter of the discs, providing increased or maximum speed on the driven machine.

The unit employs a special ball bearing countershaft on one end of which a flat-faced pulley is mounted. This pulley receives power from the Vari-Speed motor pulley and motor. On the other end of the countershaft, any standard type of drive, such as pulleys, multi - V - belts, or chains and sprockets can be applied to transmit power and provide the speed variation required on the driven machine. The countershaft is adjustable on the base proper, permitting selection of a pulley size which, in connection with the Vari-Speed motor pulley, produces the reduced speed variation required on the driven shaft.

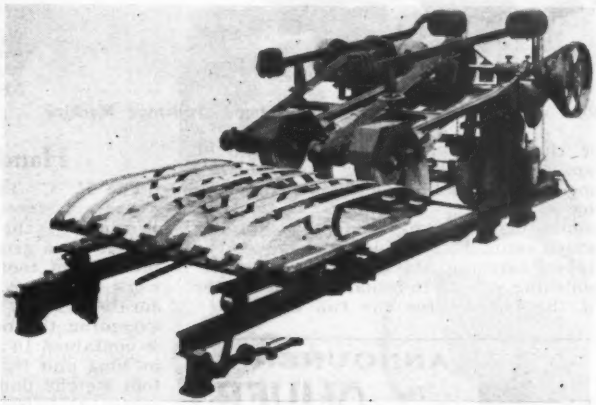
The countershaft is of special design, incorporating two ball bearings in each end. This unit, built in seven sizes, is available in from fractional h.p. to 7½ h.p., and is applicable to many kinds of variable speed requirements of light horse power, but requiring reduced speed. The entire unit has been designed to utilize every available inch of space, making possible the use of very short belt centers.

Excelsior Automatic Bumper Polishing Machine No. 27B

The machine shown in the illustration is the Excelsior Automatic Bumper Polishing Machine No. 27B, which has been placed on the market by Excelsior Tool & Machine Co., East St. Louis, Ill. The machine was designed expressly to polish automobile bumpers of the high-curve type, straight type, or edge bent bars, without reversing the bars in order to obtain a uniform finish. The finish extends almost to the eye of the bumper.

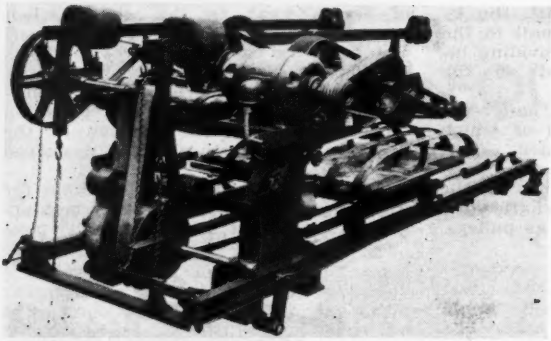
The machine is so designed that the pressure applied to the polishing wheels is equalized, resulting in the elimination of severe wear on the wheels when passing the curved surface of a bumper. The bumpers passing under the wheels in opposite directions are polished uniformly throughout. Lateral resiliency of the carriage allows the polishing wheels to follow the contour of the bumpers if they are slightly curved edgewise.

The lower carriage is adjustable for any length of bumper and can be stopped at both front and back travel position. The upper carriage, on which quick-releasing hold-down fixtures to accommodate eight bumpers are located, is shifted sidewise to the next bumper at the end of the forward or back stroke by the turning of a handwheel. The contact of the wheels with the work is always in plain view of the operator. The bumpers pass under the wheels from two to eight times, in accordance with the finish required, before the upper carriage is shifted to the next two bars to be polished. The machine is in continuous operation, the operator having ample time to remove the finished bars and replace with new ones. One man can operate two machines without difficulty.



Excelsior No. 27B Automatic Bumper Polishing Machine.

The machine is stopped only when wheels are to be changed. A special attachment is available for polishing bent bars, the attachment consisting of two brackets bolted to the lower rails on the right-hand side, on which is fastened a retainer bar to support a guide of corresponding shape to suit the shape



Rear view of Excelsior Automatic Bumper Polishing Machine.

The machine is equipped complete with belts. The spindles are mounted in oversize dust-proof bearings, and the machine is further provided with dust hoods and spouting. All parts are protected and guarded. The motor is 20 h.p., 1900 r.p.m., ball bearing, dust proof, with magnetic switch and push button control. The motor drive pulley consists of eight V-type belts with take-up adjustment. The weight of the machine is 5,600 pounds.

of the edge-bent bumper. The eight bumpers on the upper carriage are spaced by a sliding bar attached to the lower carriage. This bar, at the end contacting with the guide, has a roller which contacts the guide and moves the upper carriage sideways, allowing the polishing wheels to remain on the center of the bumper for the full stroke.

Hand-ee Grinder

The M. C. Tool Company, 120 South Aberdeen Street, Chicago, Ill., is now offering to the trade an electrically-driven hand grinder, especially designed for use on tool and die work, pattern work, or other work of a fine and accurate nature. The entire mechanism, excepting the outer end of the spindle, is contained in a cylindrical housing 4⅛ in. long and 1⅝ in. in diameter, and the tool weighs one pound. The motor operates at 10,000 r.p.m., on 110 volts, 60 cycle. The bearings are oilless.

Mounted wheels with ⅛ x 1¼-in. shanks will project beyond the end of the motor anywhere from 1¾ in. to 3 in., and with shanks 3/32 x 1½ in. will project from 1 to 2 in. Longer shanks may be had for deeper holes. Operation of the grinder is controlled by a push-button switch in the side of the housing at a point convenient to the end of the third or fourth finger. The tool comes

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The M. C. "Hand-ee" Grinder.

riety of sizes and shapes are available for use with this grinder.

Atkins Tungsten-Tipped Circular Saw

The cutting of glued, composition, and fibre materials has long presented a problem. In cutting through layers of glued materials, for instance, a high speed steel saw will fail in a very short time. After conducting a series of experiments with various types and kinds of saws under actual production conditions, E. C. Atkins & Co., 400 S. Illinois Street, Indianapolis, Ind., has brought out a circular saw with tungsten carbide-tipped teeth, especially designed for cutting the above materials.

The saw may be had with teeth of several different styles, to cut asbestos,

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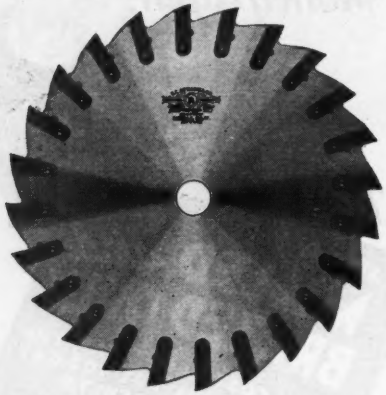
insulating materials, hard rubber, bakelite, or other materials containing gritty substances which would dull the teeth of an ordinary saw. It will take a feed



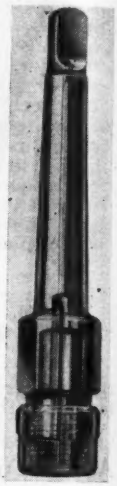
Atkins Tungsten-Tipped Circular Saw for Cutting Composition, Glued, or Fibre Materials.

of 50 ft. per min., and will operate at a speed of from 5,400 to 10,000 ft. per min., depending on the materials and the machine. The feature of the saw lies in that it will operate for a remarkably long time before requiring re-conditioning, thus effecting a saving in time and labor costs.

Jacobs Single Purpose Chuck

The illustration shows the Jacobs Single Purpose Chuck, which has been designed by The Jacobs Manufacturing Co., Hartford, Conn., for use on high production machines where multiple spindles on close center distances require a chuck with a minimum diameter, yet with great strength and gripping power.

The tool is machined to close limits, which, plus a self-centering design, insure extreme accuracy. The unique taper thread is said to provide unusual gripping power, yet the release is positive and rapid. The extreme gripping power allows end adjustment and no change in the adjustment takes place in the tightening operation. The chuck is easily tightened, on or off the machine, with any monkey wrench.

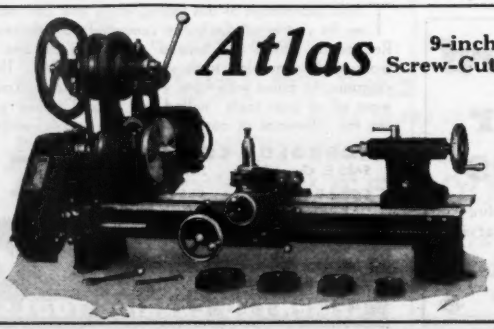


Jacobs Single Purpose Chuck.

The chuck consists of only two parts, making for simplicity and strength. Both parts are carefully heat treated and ground. Morse taper shanks are standard, but straight or special tapered or threaded applications can be provided for use on screw machines, turret lathes, or other machines. Although designed primarily for close center work, the chuck may be used to advantage on any machine where tools of a single size are held.

Parker-Kalon Cold-Forged Wing Nuts

A complete line of cold-forged wing nuts, said to be of improved design and finish, has been placed on the market by Parker-Kalon Corporation, Dept. E, 192 Varick Street, New York, N. Y. The nuts are produced by means of an



Atlas 9-inch Screw-Cutting BENCH LATHE

$79.00 Less Motor

Motor Driven Self-Contained
Complete with
Compound Rest Threading Dial
Reverse Feed to the Screw

Write for Circular

ATLAS PRESS CO.
KALAMAZOO MICHIGAN

improved high speed automatic process, and are free from flaws, roughness, and other imperfections often found in wing nuts. The nuts are also said to be stronger and better finished.

The wings of the nut are uniform and are so shaped as to provide ample

Parker-Kalon Cold-Forged Wing Nut.

finger grip for drawing up tight and for removal. They have no sharp corners or rough edges. The holes are centrally located and accurately punched, assuring a clean-cut, uniform thread. The base of the nut is smooth, with no thread burrs, and is square with the top so that it can be drawn up tight and flush with the work. Samples are available to production officials, executives, or engineers.

The Mummert-Dixon Spot Facer

. . . enables you to machine accurate and smooth surfaces on small bosses, etc., in less time than by any other method. Better investigate! Send for a bulletin.

MUMMERT-DIXON CO. 120 Philadelphia St. HANOVER, PA.

WE ARE TURNING THE CORNER

It's time to check equipment and get ready to snare your share of the business. If you expect to do any accurate boring jobs you should have the latest information about the

SWISS Precision Borer

Ask for catalog No. 510

THE R. Y. FERNER CO.
Investment Bldg. Washington, D. C.

The Hand-ee Grinder

Postpaid, with 3 Assorted Grinding Wheels

Why use a file?

$10.00

At its 10,000 revolutions per minute, the Hand-ee does in seconds what takes minutes with a stone or file—and does it better. Grinds anything—metal, glass, rubber, etc.

YOU JUST PLUG IN AND GRIND

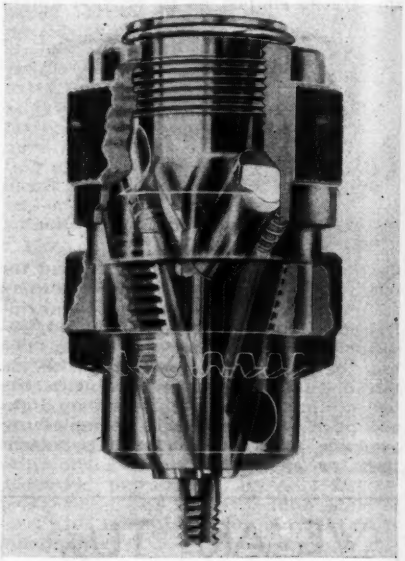
The universal motor works best on 110 volts, 60 cycle current. Weight, one pound. Folder free. Send $10.00, use it five days, return it if you wish and we will refund the $10.00.

M. C. TOOL CO.
120 South Aberdeen St., CHICAGO

Jacobs Positive Drive Tap Chuck

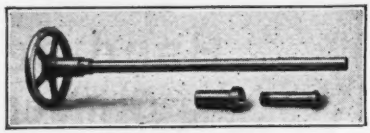
The Jacobs Manufacturing Co., Hartford, Conn., announces the Jacobs Positive Drive Tap Chuck—a chuck that is designed for heavy duty work, or for light sensitive tap holding. The chuck is so designed that the front jaws rigidly and accurately hold the tap by the shank. The back jaws positively drive the tap by the square, yet the floating construction corrects any error in concentricity between the shank and the square on the tap.

For light tapping the chuck may be hand-operated; the geared sleeve and key are provided for heavy duty tapping. The key handle of the chuck wrench fits the spanner holes on the back sleeve, and may be used where the chuck is operated on multiple spindles.



Jacobs Positive Drive Tap Chuck.

Every part of the chuck is in balance in relation to the tap spindle, and all parts are hardened and ground to insure long wear. Arbor holes are interchangeable with standard Jacobs drill chucks.



Collet Attachments for your lathes and millers

Write for Bulletin No. 100 A. M. — Rivett Draw-In Collets and Chucks. Also Price List and Dimension Sheet.

Rivett Lathe & Grinder Corp.

Brighton Dist., Boston, Mass., U. S. A.

Thread Measuring Wires

Over 250 Sizes in stock to Bureau of Standards specifications. Catalog No. 28 gives full data.

VAN KEUREN GAGES

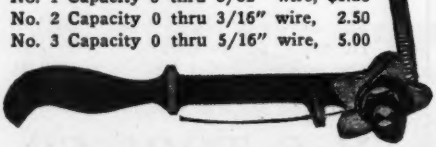
BLOCKS SNAPS
PLUGS PROFILES
RINGS SPECIALS

Quality, Price and Delivery—the best.

THE VAN KEUREN CO., Watertown, Mass.

NOW—A REAL SPRING WINDER!

No. 1 Capacity 0 thru 3/32" wire, $1.25
No. 2 Capacity 0 thru 3/16" wire, 2.50
No. 3 Capacity 0 thru 5/16" wire, 5.00



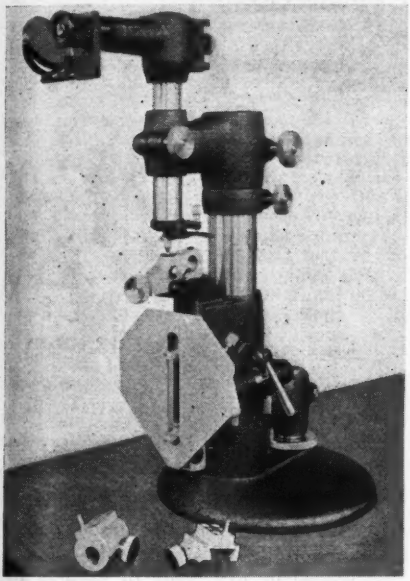
Will Earn Its Cost in One Day

The HJORTH Perfection Spring Winder offers the ideal means of winding extension, compression, torsion, taper, double taper, or left hand springs. Try one in your shop. You'll like it and the price is reasonable.

HJORTH LATHE & TOOL CO. 60 STATE ST. BOSTON, MASS.

Internal Attachment for Zeiss Vertical Optimeter

Internal measurements within a range of from ¼ in. to 4 in. in fractions of 0.00005 in. can now be obtained with the Zeiss standard Vertical Optimeter by the use of an adjustable internal attachment. The Vertical Optimeter has heretofore been limited to outside measurements, but with the internal

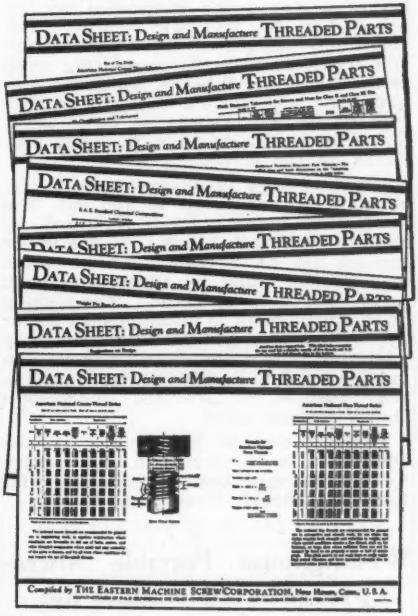


Zeiss Vertical Optimeter with Vertical Attachment.

attachment it is readily converted into an inside comparator gage. The extreme accuracy of the instrument is retained, and the attachment can be adjusted so that bores as small as ¼ in. and as large as 4 in. can be checked with the same equipment. Means are also provided for determining taper and for finding both minimum and maximum diameter of the bore.

The attachment is fully self-contained. It will fit any standard Optimeter now in use simply by slipping it over the vertical post and clamping it in position. It is constructed with two meas-

DATA SHEETS ON THREADED PARTS


DATA SHEET: Design and Manufacture THREADED PARTS
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Compiled by THE EASTERN MACHINE SCREW CORPORATION, New Haven, Conn., U.S.A.

No. 1—Important suggestions for designs that reduce cost.
No. 2—Coarse and fine pitch series with complete basic data.
No. 3—Tap drill sizes recommended for coarse and fine thread series.
No. 4—Classification of fits with tolerances for Classes 2 and 3.
No. 5—Data on pipe threads, taper and straight, and threads for brass tubing.
No. 6—Tables showing S.A.E. standard chemical compositions of steels for various uses.
No. 7—Charts on cutting speeds and net production per hour.
No. 8—Weights per foot of different stocks.

These data sheets are only valuable to you if you are engaged in the designing or manufacturing of threaded parts. Write us on your firm letterhead and we will gladly put your name on our mailing list. In writing, please let us know if you use self-opening die heads.

EASTERN MACHINE SCREW CORPORATION
140-150 Truman St., NEW HAVEN, CONN.
Manufacturers of World-famous H & G Self-Opening Die Heads.

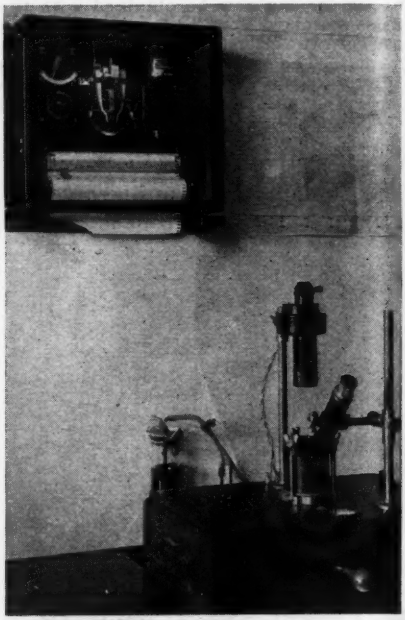
uring jaws which contact by means of ball tips with the ring to be gauged. The upper one is adjustable, but fixed in position during the measuring operation, the ring being suspended on the upper jaw by its own weight. The lower jaw completes the measurement and transfers it to the measuring anvil of the Optimeter tube, by which the amplification is performed optically so that 1/10,000 in. will appear as large as $\frac{1}{8}$ in. in the ocular or as $\frac{1}{8}$ in. when projected on the screen.

Taper of bore is observed visibly by shifting the back plate in and out. The maximum diameter is determined by slightly swinging the ring on the upper contact tip as a pivot. The medium diameter is found by tilting the back plate in a vertical plane. The setting of the instrument is accomplished either by the use of a master ring or a snap gage built up from block gages. An independent fine adjustment for the zero position is provided underneath the measuring anvil.

The attachment, the same as the Optimeter, is distributed in this country by the George Scherr Company, 128 Lafayette Street, New York, N. Y.

Westinghouse Portable Micropyrometer Determines the Melting Points of Alloys

An ingenious micropyrometer has been developed by the Westinghouse Research Laboratories, East Pittsburgh, Penna., to determine the melting points and viscosity of metals and alloys. Designed particularly to study the characteristics of welding slag, it is expected to find many applications in other fields. In operation, a minute test piece of welding slag or alloy is placed on the platinum strap, which is suspended from two insulated terminals, and current applied from the low-voltage winding of a step-down transformer. The heating chamber is gas-tight, since the melting point determinations are made in various atmospheres or a vacuum. Observation is made by means of a microscope with a magnification of 100 to 1, through a clear quartz window. When fusion is seen to



Westinghouse Micropyrometer and temperature rcorder.

WEL-DON END MILLS
With the "Double Back-off"

HIGHEST SPEEDS
FASTEST FEEDS
Stocks in all chief cities

"Double Back-off" means stiffer cutting edge for same clearance angle—therefore heavy feeds without chattering. Retains correct diameter and keeps keen edge longer. Allows clean, free cutting at higher feeds. Flutes are *Hollow-Ground*.

The WELDON TOOL CO., 1426 W. 3rd St., Cleveland, Ohio

begin, the current is at once shut off.

Temperature is automatically recorded on a chart by an ardometer (total radiation pyrometer) which collects the heat rays passing through a quartz window and focuses them on a disc containing thermocouples leading to the recording instrument. Readings are taken in millivolts and read in degrees centigrade from a curve previously plotted from readings taken of metals and alloys with known melting points.

The instrument consists of a heating chamber in the form of a brass cap clamped by thumb screws to a brass base; a heating element, which is a platinum strip 0.5 inch wide and 0.0005 inch thick; a microscope for viewing the beginning of fusion; and an ardometer for registering temperature.

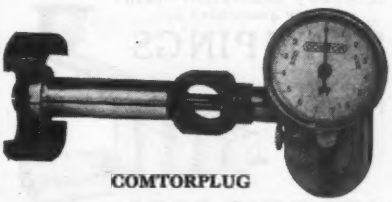
Control of the current is handled on the high-voltage side of the transformer; hence the current in the control apparatus is small. On the low-voltage side it has a range up to 40 amperes. A motor-driven rheostat, also operable manually, controls the voltage applied to the primary and provides a steady increase of current during a test. The motor speed may be varied to suit conditions. The new instrument is not only more accurate than similar devices hitherto made by this company but is portable and occupies only a small fraction of the space required by its predecessors.

Improved Rod for Electric Welding 18-8 Stainless Steels

A welding rod that is especially applicable for use in the welding of Allegheny Metal and other stainless steels in the 18-8 chrome nickel group has been announced by Jos. T. Ryerson & Son, Inc., 16th and Rockwell Sts., Chicago, Ill. An important factor in the performance of the rod is the special flux coating, which produces a non-active gas that surrounds the hot metal and prevents the oxygen of the air from attacking the metal and forming oxides. The heavy slag formed on top of the weld acts as a protective agent as the metal cools. Thus the difficulties that have been encountered in the past in welding stainless steels are avoided.

When welding with the improved electrode it is unnecessary to remove the slag before laying down the next bead;

COMTOR



COMTORPLUG

A MEASURING INTERNAL GAGE

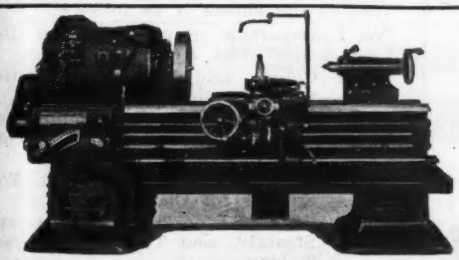
PRECISE TO ONE HALF TEN THOUSANDTH INCH

Accurate—Durable
Sensitive—Easy to operate

¼ inch to 8 inches

Send us your diameters and tolerances and let us make specific recommendations. We also make measuring external gages.

THE COMTOR COMPANY
WALTHAM, MASS.



A Safe Bet!

When you want a lathe that will increase your production and cut your costs... specify a SPRINGFIELD *Precision* TOOL ROOM LATHE. Past performances prove that it is a Safe Bet!

The Springfield Machine Tool Co., 630 West Southern Ave., Springfield, Ohio

thus the operator is enabled to work faster and at the same time to secure better penetration. Tests have shown a carbon increase in bead of about 0.01 per cent as compared to the original rod, making the corrosion resistance of the deposited metal equal to that of the parent metal and leaving the weld soft enough for machining.

Firms that employ the welding process in fabricating Allegheny Metal or other stainless steels may secure samples of the new rod by writing direct to the Ryerson Company.

MECHANICAL DEVICES
of every description—completely assembled or
STAMPINGS
Quantity Production or Sample Runs

GERDING BROS.
Mechanical Productionists 5 E. 3rd St., Cincinnati, Ohio

Always On the Job

GUSHER pumps give a full flow of coolant instantly, continuously and unfailingly. Their simple, perfected construction guarantees long life and dependability.
Gusher Pumps are always on the job.
Model ULO
Catalog sent on request.
GUSHER COOLANT PUMP
The Ruthman Machinery Co.
532 E. Front St. Cincinnati, Ohio

Aristo No. 1 Timer

The Aristo Import Company, 14 John Street, New York, N. Y., is now marketing a stop watch, the large hand of which registers the seconds and fifth-seconds up to 60, and the small hand, the minutes up to 30. First pressure

Aristo No. 1 Timer

on the crown starts the mechanism, a second pressure stops it, and a third brings both hands back to the starting point, which is zero.

The workmanship on this watch is of the highest grade, and the watch is said to be extremely accurate. For engineers, time-study men, or others who have need for a split-second watch of this type, this instrument will undoubtedly fill the need.

Data Sheets On Threaded Parts

The Eastern Machine Screw Corporation, 140-150 Truman Street, New Haven, Conn., is now putting out sets of data sheets on threaded parts which can be had by any designer or manufacturer of threaded parts who will address his request on his firm letterhead. The text of the sheets is as follows:

No. 1—Important Suggestions for Designs that Reduce Costs.

No. 2—Coarse and Fine Pitch Series with Complete Basic Data.

No. 3—Tap Drill Sizes Recommended for Coarse and Fine Thread Series.

No. 4—Classification of Fits with Tolerances for Classes 2 and 3.

No. 5—Data on Pipe Threads, Taper and Straight, and Threads for Brass Tubing.

No. 6—Tables Showing S. A. E. Stand-

ard Chemical Compositions of Steels for Various Uses.

No. 7—Charts on Cutting Speeds and Net Productions Per Hour.

No. 8—Weights Per Foot of Different Stocks.

When writing for these sheets, it is requested that the writer indicate whether he uses self-opening die heads.

Continental Interchangeable Counterbore Catalog No. CT-132

The Continental Tool Works Division of the Ex-Cell-O Aircraft & Tool Corporation, at 5835 Martin Avenue, Detroit, Michigan, has released Catalog No. CT-132 of the various types of interchangeable counterbores, core drills, inverted spot facers, interchangeable countersinks, combination tools, inserted blade tools, special tungsten carbide-tipped tools and other tools made by this company. A chart for calculating the amount of steel required for a job is included, together with suggestions for sharpening counterbore cutters and core drills. Copy free upon request. The book consists of 28 pages, and is profusely illustrated.

For Cost and Production Analysis

Makes one revolution of 100 divisions in one minute. Other Timers with different calibrations. Watches sold on trial for one week. If not satisfactory, return watch at no cost or obligation.

No. 20

Price $15.00, Postpaid

We repair Stop Watches of all makes at reasonable prices. Send for Free Booklet on Time and Production Study.

ARISTO IMPORT COMPANY
14 John St., New York, N.Y.

CULLMAN SPROCKETS

for

Roller, Block *and* Silent Chains

Send for Catalog

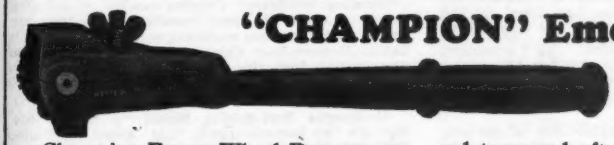
CULLMAN WHEEL CO.
1336 ALTGELD STREET CHICAGO

A Hardness Tester

Never guess about things you can measure. The Duroskop measures the hardness of most metals with but little preliminary fuss. Readings can be made in two seconds.

Ask for bulletin No. H-4

THE R. Y. FERNER CO.
Investment Bldg. Washington, D. C.



"CHAMPION" Emery Wheel Dressers!

Champion Emery Wheel Dressers are built for quick action. The cutters are made of a special steel, heat treated and tempered after they are formed, and will sharpen a dull or glazed wheel faster than any other method.

Send for Details NOW!

THE WESTERN TOOL & MFG. CO., Springfield, Ohio

For Your Catalog Library

Check any of these useful publications that you want, write your name, firm name, title, and address on the margin, then tear out the page and send to Modern Machine Shop, 128 Opera Place, Cincinnati, Ohio. They will be forwarded to you promptly without cost or obligation. Please restrict your list to not more than ten.

Chucks—Key and Keyless: Bulletin No. 120A, issued by T. R. Almond Mfg. Co., Ashburnham, Mass., describes and illustrates the line of key and keyless geared nut and ball bearing drill chucks made by this firm. Copy free upon request.

Cut Your Sawing Costs: "Lenox" hack saw blades and band saws are guaranteed to effect savings on your sawing operations. Write for information to American Saw & Mfg. Co., Springfield, Mass.

Ames Gages: Catalog No. 50, issued by the B. C. Ames Company, Waltham, Mass., contains complete descriptions and illustrations of the dial gages, gage heads, upright gages, cylinder gages, dial micrometers, and precision verifiers, special gages and attachments made by this company. Copy free upon request.

Machine Shop Accessories: Catalog B-27, issued by the Armstrong Bros. Tool Co., 328 N. Francisco Ave., Chicago, Ill., describes the line of tool holders, boring tools, wrenches, pipe tools, ratchet drills, lathe dogs, and other tools manufactured by this company.

Time Study Watches: A folder containing illustrations and descriptions of the split-second watches, decimal watches, and other timing watches marketed by Aristo Import Company, Inc., 12 John Street, New York, N. Y., can be had by addressing a request to the firm as above.

"Atlas" Bench Lathe: A 9-in., screw cutting, self-contained, motor-driven bench lathe is now being built by Atlas Press Co., Kalamazoo, Mich. Write for circular.

Greenerd Arbor Presses: Catalog No. 36, issued by the Edwin E. Bartlett Co., Nashua, N. H., describes and illustrates all the various types and sizes of arbor presses made by this firm. Copy free upon request.

Drop Forged Steel Die Sets: The economy and other advantages of drop forged steel die sets, which are now being made by E. A. Baumbach Manfg. Co., 1806 South Kilbourn Avenue, Chicago, Ill., are explained in a folder that can be had by addressing this firm.

Carboloy Tools: Handbook M32, issued by Carboloy Company, Inc., 2485 East Grand Boulevard, Detroit, Mich., describes the tools made by this firm, and also includes information regarding manufacturing, brazing, and grinding Carboloy tools. Copies free to mechanical executives.

Comtorplugs: Interchangeable plugs for internal gaging, from .250 in. to 8 in. dia. and up to 24 in. in length, graduated by an amplifier to .0001 in., are described and illustrated in a circular that has been issued by The Comtor Company, Waltham, Mass. Copy free upon request.

Motorize Your Cone Pulley Lathes: An attachment that can be applied to your lathe with four bolts makes it possible to motorize and modernize your lathes. Write for information to Cullman Wheel Co., 1336 Altgeld St., Chicago, Ill.

Die Makers' Supplies: A complete line of die sets, leader pins, bushings, and other die makers' supplies are described in a book that is issued by the Danly Machine Specialties, Inc., 2104 South 52nd Avenue, Chicago, Ill. Sent free upon request.

Steel Spacing Washers: Milling jobs can be set up quicker by using standard spacing washers, made by Detroit Stamping Co., 3445 West Fort Street, Detroit, Michigan. Write for information.

Data Sheets on Threaded Parts: The Eastern Machine Screw Corporation, 140-150 Truman Street, New Haven, Conn., is now putting out sets of data sheets on threaded parts which can be had by any designer or manufacturer of threaded parts who will address his request on his firm letterhead. State whether or not the firm uses self-opening die heads.

"Speed" Spot Welders for welding metals from 0.0005 in. to 5/8 in. thick are described in a catalog that can be had by addressing Eisler Electric Corp., 761 South 13th Street, Newark, N. J.

The Red Liner is an automatic machine that inspects gears under conditions similar to those of actual operation, and charts errors on a 200-to-1 scale. Write Fellows Gear Shaper Company, Springfield, Vt., for booklet.

Performance Data On Swiss Jig Borers: This 36-page pamphlet shows various types of jobs from a power shovel turntable jig to a television disc, drilled and bored on Societe Genevoise High Speed Precision Borers, giving data as to size of holes, accuracy and time savings. Free upon request to The R. Y. Ferner Co., 1008 K Street, N. W., Washington, D. C.

Formica Silent Composition Gears: A booklet telling about the uses and advantages of Formica Silent Shock Absorbing Gears, and containing a considerable amount of valuable data with rules and tables for laying out, cutting and using gears. Sent free by Formica Insulation Co., 4632 Spring Grove Avenue, Cincinnati, Ohio.

Stampings of any kind or size can be obtained from Gerding Brothers, 5 East Third Street, Cincinnati, Ohio. Write for particulars.

Ball and Roller Bearings, either journal or thrust, for all purposes and in all sizes, are described and illustrated in catalog No. 9 which has been issued by The Gwilliam Company, 360 Furman Street, Brooklyn, N. Y. Copy free upon request.

Precision Bench Lathe Work can only be done on finely-built, accurate machines. The complete line of Hjorth Precision Bench Lathes is described and illustrated in a catalog that has been issued by Hjorth Lathe & Tool Company, 60 State Street, Boston, Mass. Copy free upon request.

Oil and Waterproof Chucks: The J & H Electric Co., 202 Richmond Street, Providence, R. I., is now making a chuck that is oil and waterproof, and is designed to provide a maximum of holding surface with exceptionally strong and uniform pull throughout. Ask for complete information.

Threading Machinery: Complete catalogs of individual bulletins covering the pipe threading and cutting machines, bolt threading machines, or die heads made by Landis Machine Co., Waynesboro, Penna., may be had upon request from this firm. State size and type of machine or die head concerning which information is required.

Air-Operated Work-Holding Devices: A booklet showing how air-operated chucks and devices of various kinds can be applied to different kinds of machines to save time and labor has been issued by The Logansport Machine Co., Logansport, Ind.

Master Complete Power Drive: Booklet S210, issued by The Master Electric Company, 104 Davis Ave., Dayton, Ohio, describes and illustrates the Master Geared-Head Motor in service, with applications to all kinds of drives. Copy gratis.

"Hand-ee" Grinder: A grinder for use on dies, tools, and other fine work, made to fit the hand, weighing one pound, with plug to operate from light socket, is described in a folder that can be had by addressing the M. C. Tool Co., 120 South Aberdeen St., Chicago, Ill.

Compound Spot-Facing Tool: A spot-facing tool retracting, serrated roughing cutters and fixed finishing cutters in the same tool will break up the scale easily and do accurate work. Write for bulletin to Mummert-Dixon Co., 120 Philadelphia St., Hanover, Penna.

Ball and Roller Bearing Data Sheets: A complete set of data sheets showing all the dimensions and loads at given speeds, and giving instructions for mounting precision ball bearing and Hoffmann roller bearings, can be obtained without charge by addressing the Norma-Hoffmann Bearings Corporation, Stamford, Conn.

"Commercial Lapping for Close Limits and High Production" is the title of a booklet that discusses hand and machine lapping, types of lapping tools and machines, workholders for machines, preparation of laps, preparation of work for lapping and other important points. A copy may be had by addressing Norton Company, Worcester, Mass.

Die Making Machines: How dies, templates, gages, etc., can be sawed out, filed, and lapped easily and accurately on Oliver die making machines is fully described in a bulletin issued by the Oliver Instrument Company, 1450 Maumee Street, Adrian, Mich. Mailed upon request.

Good Gears of all kinds—spur, spiral, bevel, worm, hypoid—in fact, any kind or type of gear desired, large or small, machined to an excellent finish and the highest degree of accuracy, may be obtained from Perkins Machine & Gear Co., 151 Circuit Ave., Springfield, Mass. Write for estimates.

Bench Lathe Mounting and Driving Equipment: Bulletin 120-A, issued by Rivett Lathe and Grinder Corporation, Brighton, Mass., contains complete descriptions and illustrations of modern and conventional countershaft, individual motor drive jackshaft, and speed box motor drive, also benches, cabinets, oil pans, etc. Copy free upon request.

Automatic Lubrication: Individually motor-driven pumps that keep the work flooded with lubricant are described in a booklet that has been published by the Ruthman Machinery Co., Front and Pike Sts., Cincinnati, Ohio.

Steel Stamps and Marking Dies: Full information as to steel stamps, steel roller dies, embossing dies, and embossing rolls made by the Schwerdtle Stamp Co., 10 Cannon Street, Bridgeport, Conn., can be had by writing this firm.

Speed and Accuracy in Straightening: The Springfield Straightening Press is an ideal tool for use in straightening any length or size of rough or finished work. Send for illustrated folder. Address The Springfield Machine Tool Co., 630 West Southern Avenue, Springfield, Ohio.

Hardening Simple Tools and Parts: Instructions as to the hardening and tempering of small high speed and carbon steel tools and sections can be had, together with a circular describing the "ElectroBat" High Speed Muffle Furnace, by addressing a request to Stark Tool Company, Waltham, Mass.

Cutting and Grinding Facts: A discussion of cutting oils and lubricants, together with descriptions and illustrations of various kinds of jobs upon which cutting oils are used, is contained in a booklet that is issued by the Sun Oil Company, 1608 Walnut Street, Philadelphia, Penna. Free upon request.

Chuck With Air: How time and labor can be saved by the use of air-operated chucks, cylinders, and other equipment is told in a book which describes "Hopkins" Air-Operated Equipment. Published by The Tomkins-Johnson Company, 620 N. Mechanic St., Jackson, Mich. Sent free upon request.

Electrically-Driven Portable Tools: The "U. S." line of electric drills, die grinders, surface grinders, tool-post grinders, and bench and floor grinders is described in Catalog No. 33, published by The United States Electrical Tool Co., 2471 West Sixth Street, Cincinnati, Ohio. Copy free.

How To Measure Threads with Wires: Circular W26, issued by The Van Keuren Co., Watertown, Mass., tells how to obtain the correct thread pitch diameter with a micrometer and wires. Copy free upon request.

Double-Life End Mills: Weldon Double-End Type End Mills, made with blades on each end, are described in Catalog No. 6, issued by The Weldon Tool Company, 1426 West Third Street, Cleveland, Ohio. Other small tools made by this firm are also described and illustrated in this catalog.

Shop Furniture: A catalog describing and illustrating all kinds of shop furniture, including benches, vises, steel stands, foremen's desks, chip trucks, steel racks for bar stock, steel tote boxes, and other equipment will be sent free upon application to The Western Tool & Manufacturing Co., 1620 East Pleasant Street, Springfield, Ohio.

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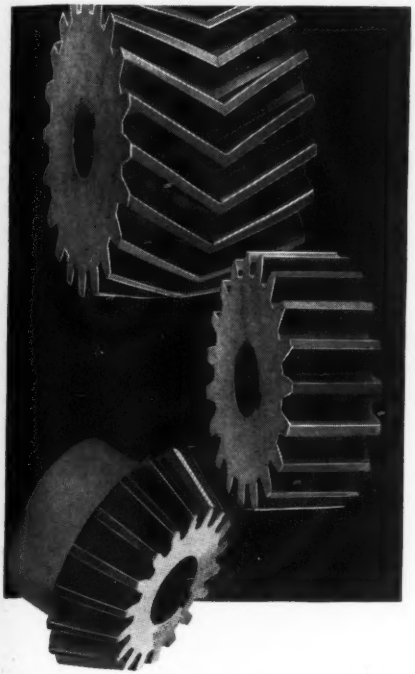

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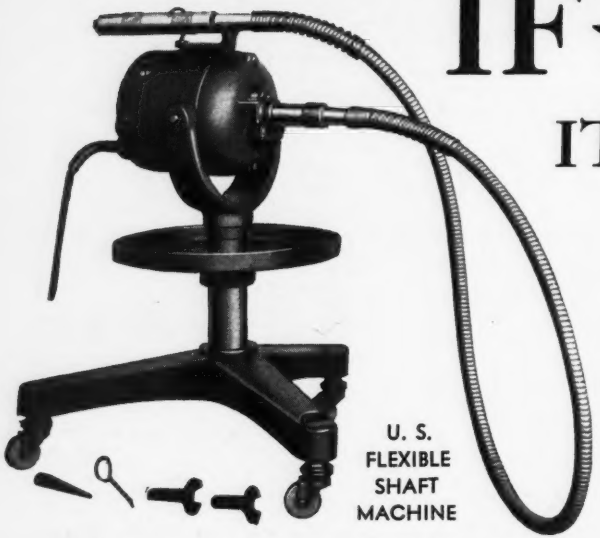

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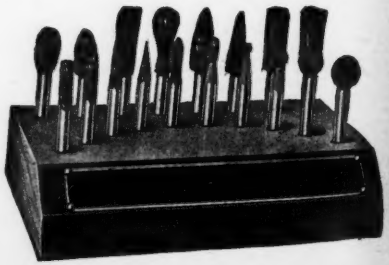

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